JULY, 1942

JUL 17 1942

PUBLIC WORKS

Streets and Highways . . . Water Works
Sewage Disposal . . . Airports

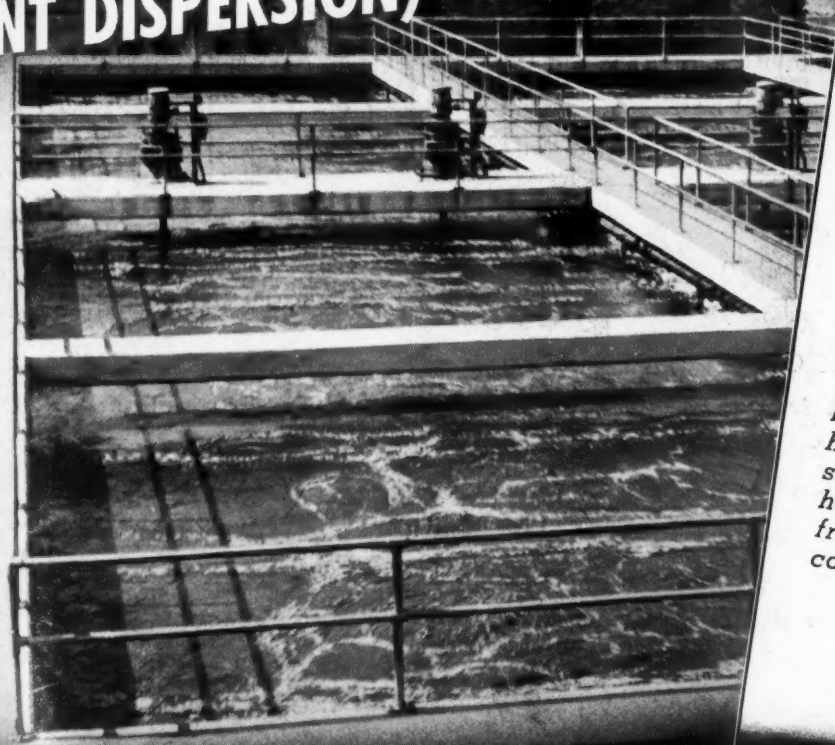
UNITED WE STAND

WHAT WILL BE THE CONDITION OF-

POZZOLITH CONCRETE IN 1950?

EMENT DISPERSION)

READ THIS RECORD FOR THE ANSWER...



GEORGE B. SOWERS
CONSULTING ENGINEER
1836 EUCLID AVENUE
CLEVELAND

June 16, 1942

The Master Builders Co.
Cleveland, Ohio

Gentlemen:

I beg to submit the following report upon the present physical conditions of the concrete walls of the Mansfield, Ohio sewage treatment plant which was built in 1936.

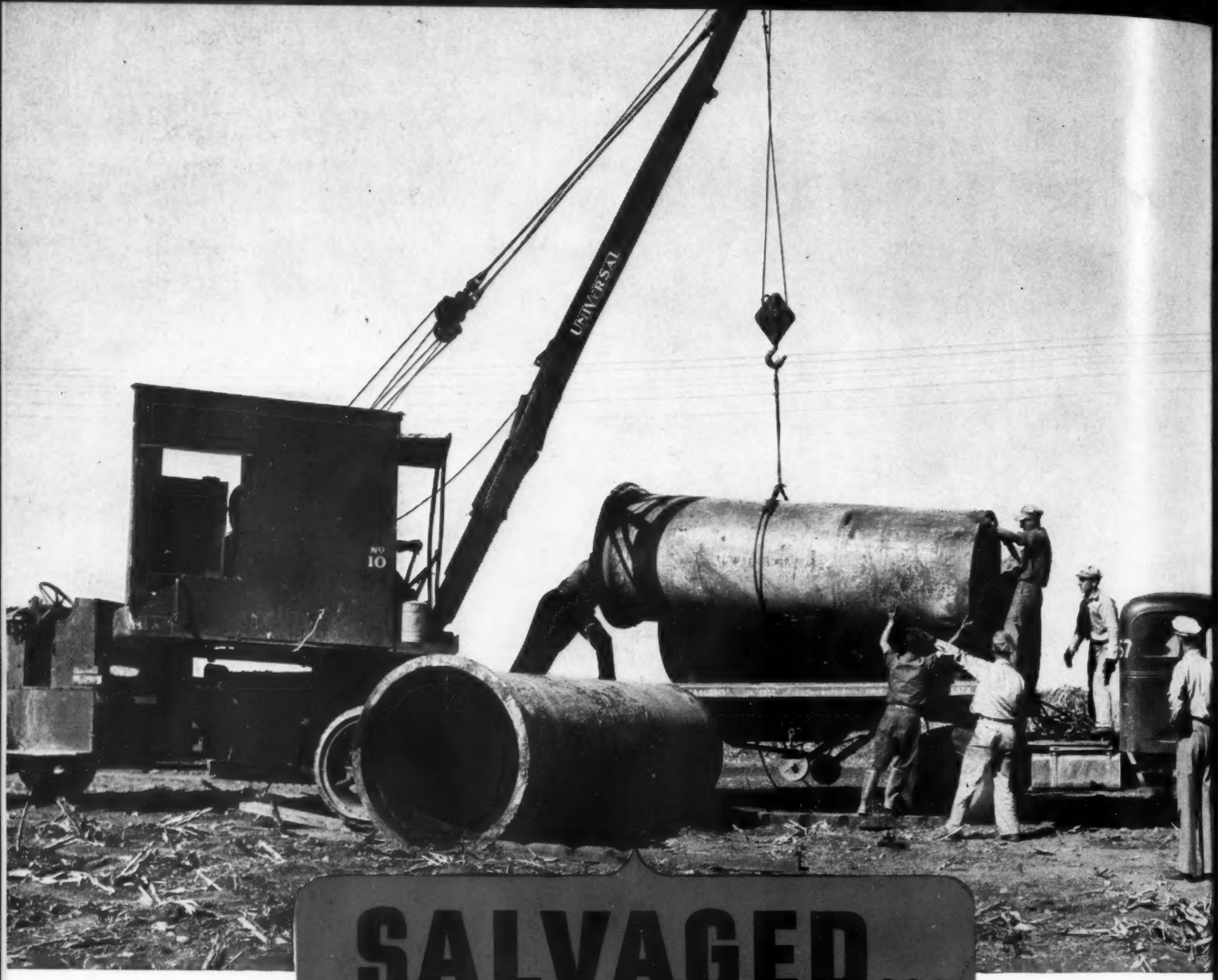
All of the concrete, including the bottom of the tanks which recently have been cleaned and inspected, is sound and in perfect condition. There has been no disintegration, either from frost action, sewage action, or other causes, not even at the waterlines.

Very truly yours,
Geo B Sowers
Consulting Engineer

end for Research Paper Number 36, "Economics of Cement Dispersion", and complete information on Pozzolith.

THE MASTER BUILDERS COMPANY
CLEVELAND, OHIO TORONTO, CANADA

MASTER BUILDERS



SALVAGED... for an extra dividend

Loading salvaged 48-inch cast iron p
trucks at Columbus, Ohio. After 3
service, without any maintenance c
pipe was taken up and sold by the c
substantial price per ton, over and a
removal expense.

● Thirty-seven years ago the city officials of Columbus, Ohio, authorized the construction of a cast iron sewer force main more than a mile long and 4 feet in diameter. Since that time, 160 billion gallons had been pumped through this cast iron line without one cent of maintenance cost on the pipe.

Recently the city completed a new sewage treatment plant and large intercepting sewer, making the old main unnecessary for further duty. Since it was cast iron pipe, it was possible to salvage 1150 tons of materi for either re-use or re-sale. The pipe was sold at a substanti price per ton, representing *an extra-dividend to the taxpaye* of Columbus.

It is impossible to foretell future requirements or pop lation shifts in metropolitan cities but any public official c be sure that, when water or sewer mains must be abandon or rerouted, the pipe can be salvaged or re-use *if it is cast iron pipe.*

Pipe bearing this mark is cast iron pipe.

TRADE MARK REG.

Available in diameters from 1¼ to 84 inches.

CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1013 PEOPLES GAS BUILDING, CHICAGO, ILLINO

CAST IRON PIPE

PUBLIC TAX SAVER NO. 1

The WAR EMERGENCY
AS IT AFFECTS PUBLIC WORKS

An All-Out War for a Nation of Scrappers

We can not all fight in personal contact with the enemy; many are too old or young or too valuable in war industries. But we can all be scrappers—contributors of scrap materials needed for war construction. From now until the war is won we must see to it that we get *All* (the scrap) *Out* and sent where it will do the most good.

A national campaign is on to bring this about, and it is the duty of the officials of every community to see that their community does its part. They should stimulate their citizens to search out all the metals and rubber that are not in use, and make it easy for them to get them to designated collection points. And (remember the lawyer who did not make a will?) see that the highway, sewer and other departments turn in all that *they* do not need. If an old maintainer or other equipment can be repaired, do it at once. If it is not repaired now, it probably never will be; so turn it in as scrap. Clean up the department's store houses and yards so that there is nothing left in them that is not usable and needed. The chances are that you will be surprised to find how much junk has been needlessly cluttering them up for years.

Just what to collect and what to do with it will be communicated to all communities by Federal and State salvage organizations, directly and through advertisements. A State Salvage Committee has been appointed in every state, and it is its duty to see that every community has a working salvage committee and that it knows what to do and how to do it—and does it.

Your boys, or your neighbor's, are fighting "over there." Do your part to see that they get what they need to fight with, and that it is not too little or too late.

"Smugness" or Justifiable Confidence?

The press recently quoted an army officer as saying: "So far we have been shellacked all over the globe; we have lost everything except our smugness." On the other hand Link-Belt Company says: "We view this crisis not with alarm—but with confidence. Every lathe, every drill, every tool in our plants has been turned into a weapon of war; every worker, man or woman, into a productioneer—a soldier in overalls. Such spirit, such skill, such strength cannot lose."

Read this inspiring statement on page 48; then ask yourself which is correct.

Priorities Procedure Simplified

Effective July 1, any preference rating, no matter how it has been assigned, may be applied or extended by a single form of certification, which states merely that the purchaser certified to the seller and to the War Production Board that he is entitled to use the preference ratings indicated on his purchase order, in accordance with the terms of Priorities Regulation No. 3; and which must be accompanied by the identification symbols required by Priorities Regulation No. 10.

Provisions of existing orders which require a purchaser to furnish his supplier with copies of preference rating orders or other special certifications are all rescinded, except for the special provisions of Priorities Regulation No. 9 with respect to the application of preference ratings for certain types of exports. This change does not, however, affect any provision of existing preference rating orders which limits the kinds of material which may be obtained by use of the assigned rating, or which requires specific information or purchase orders.

Emergency Priority Assistance. Officials encountering difficulty or delay in securing adequate priority ratings for emergency maintenance, repair, and operating requirements should communicate with the Bureau of Priorities Emergency Assistance, Maintenance and Repair Branch, Temporary Building E, Washington, D. C., giving the following information:

Name of applicant; address. Address of receiving plant, description and quantity of material requested. Supplier's statement: delivery promised on ..... with rating of ....., Purchase order number. Value. Name of supplier. Description of product. Relationship to war program, public safety or health. Is applicant operating under any priority order? If so, state order number, serial number and reason for this application. Concise statement of emergency situation.

A Census of State Highway Equipment

A survey of all construction equipment owned by Highway Departments of the various States and other local Government units has been completed by the Bureau of Governmental Requirements, and is now available for use by all Government agencies. Responses were received from all states having highway departments and virtually all of more than 3,000 counties sent questionnaires, 1,100 cities of 10,000 population and over, and 3,500 cities and towns under 10,000 population.

The survey as completed lists 34 types of equipment, with details as to age and condition. Maury Maverick, Chief of the Bureau, says that many governmental agencies have already found the survey helpful in locating equipment which can be leased or rented by one highway department to another for important war work.

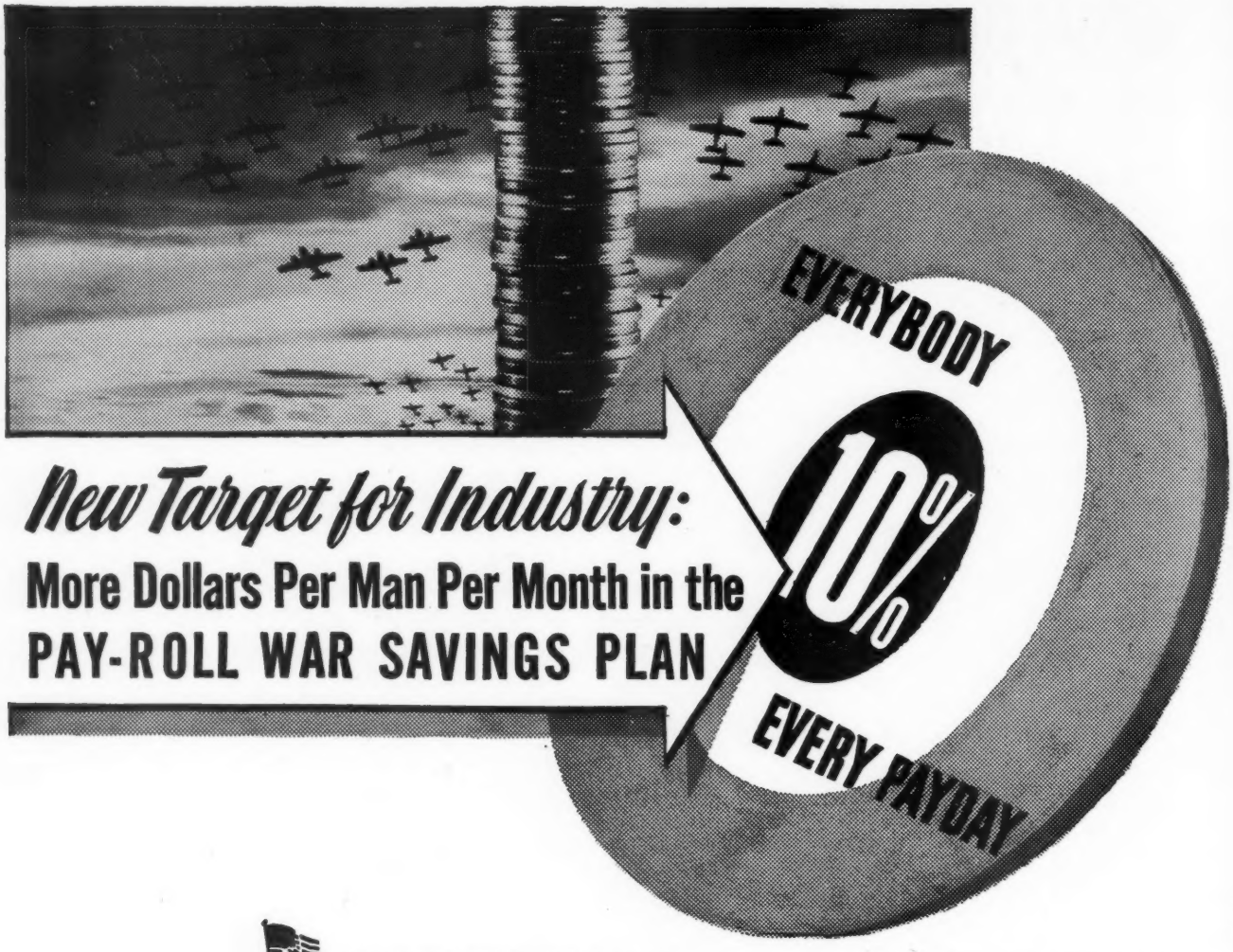
Tin Cans in Kansas, Missouri and Texas

Since June 1st detinning plants have come into operation at Dallas and Houston, Texas, and Kansas City, Missouri, and tin cans are now being collected in areas surrounding those cities, as well as those named last month on this page.

Bituminous Materials for Highways

Under date of July 4th, control of bituminous materials in public highway work is extended to cover all the country from the Atlantic to the western borders of New Mexico, Kansas, Nebraska and the Dakotas. In this area the use of any asphalt or tar product is to be deferred for the duration, unless certified by the Public Roads Administration as "necessary to the successful prosecution of the war." To obtain such certification, application must be made on a special form B-1 to the State Highway Dept.; which, if it approves, forwards it to the District Engineer of the P.R.A. for his approval.

(Continued on page 30)



New Target for Industry:

More Dollars Per Man Per Month in the PAY-ROLL WAR SAVINGS PLAN

TO WIN THIS WAR, more and more billions are needed and needed fast—AT LEAST A BILLION DOLLARS A MONTH IN WAR BOND SALES ALONE!

This means a *minimum* of 10 percent of the gross pay roll invested in War Bonds in every plant, office, firm, and factory in the land.

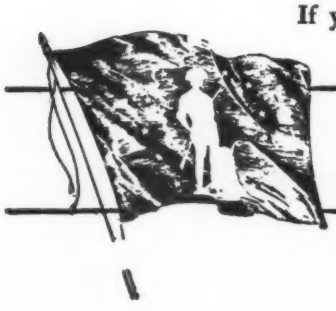
Best and quickest way to raise this money—and at the same time to "brake" inflation—is by stepping up the Pay-Roll War Savings Plan, having every company offer every worker the chance to buy MORE BONDS.

Truly, in this War of Survival, VICTORY BEGINS AT THE PAY WINDOW.

If your firm has already installed the Pay-Roll War Savings Plan, *now is the time—*

1. To secure wider employee participation.
2. *To encourage employees to increase the amount of their allotments for Bonds, to an average of at least 10 percent of earnings—because "token" payments will not win this war any more than "token" resistance will keep the enemy from our shores, our homes.*

If your firm has not already installed the Pay-Roll War Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write, wire, or phone: War Savings Staff, Section E, Treasury Department, 709 Twelfth Street NW., Washington, D. C.



U. S. War Savings Bonds

This space is a contribution to America's all-out war program by

PUBLIC WORKS MAGAZINE

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 55-57

PUBLIC WORKS Magazine . . . JULY, 1942

VOL. 73. NO. 7

The glen shown below after flattening slopes, transforming culvert and removing standard guard rail.

The Economical Landscaping of State Highways

By ROBERT S. GREEN

Supervising Landscape Engineer, N. J. State Highway Department

In addition to everyday utility and the reduction of annual maintenance costs on roadsides, landscaping may offer in war times the protective concealment so desirable. Application of this principle may avoid necessity for later costly camouflage. The data given herein are from a paper before the Highway Officials of the North Atlantic States.

TO ECONOMICALLY landscape our State highways, we must endeavor to merge our plantings into the surrounding country, whether fields or wooded areas, to such an extent that the newly constructed artery becomes an integral part of the picture; that it fits within a natural setting.

These plantings, whether of trees, shrubs or expansive lawn areas, must be constructed on a large scale to become a part of the vast stretches of various types of country through which the highways pass. Material in all cases must be of a selection to correspond with the natural surroundings—collected from adjacent lands where economical and practical, or purchased from nurseries propagating native plant material.

Beginning with a new alignment, and before property purchases are made, the landscape engineer should work in cooperation with the construction engineer, suggesting alternate locations to avoid heavy cutting through dense woodland or to take advantage of streams and small bodies of water which might border the future highway—both to provide natural scenic beauty for the traveling public.

Improved by selective cutting, the adjacent woodland within the right-of-way may provide shaded

The wooded glen (above) being thinned and stumped in 1939.

30-foot road extends through trees in the rear, where sandy soil will support trucks the greater part of the year.

retreats for relaxation and, with construction of lanes and spurs, furnish ideal locations for the protective concealment of motor convoys and troop movements during an emergency such as now exists.

Roadside turnouts may border nearby streams or ponds and may be improved by the construction of rustic guard rail and lawn areas for picnic purposes. Where historical monuments or markers are situated, similar turnouts and rest areas may be constructed and thus emphasize the history of both the State and country.

We can readily understand, however, that such changes are possible only in some instances where the change in alignment would not involve too great an increase in road construction costs or add excessive mileage to the proposed route.

Of primary importance is the necessity of purchasing sufficient right-of-way to accommodate the traffic needs of the surrounding locality and to include adequate land on either side of the traveled highway for roadside improvement. This is closely followed by the design of the highway and its cross-section.

The width of right-of-way may vary, depending on the density of population and land valuation. The amount for landscaping through commercial centers will be at a minimum. However, it is imperative that in other sections sufficient land between curb and property line be set aside for roadside improvement. This strip of land may, in some cases, be purchased as part of the right-of-way. In other instances, an easement might be obtained for a uniform width throughout the length and on either side of the proposed route.

These areas not only prevent encroachment of unsightly objects, but screen existing sore spots, provided the native plant material is allowed to remain subject to proper landscape practice. In this case, whether the highway can be landscaped immediately after road construction is completed or at a later date does not matter greatly. The roadside appearance will be at least as it was when a country road—native to the surrounding countryside.

While an extensive width between curb and right-of-way boundary may be advantageous from a landscape point of view, the expense involved in purchase, construction and subsequent maintenance must be considered. The distance may vary when passing from fairly level areas to sections through cuts and fills, the latter requiring greater widths depending on the degree of slope encountered. The maximum slope desired, whether cut or fill, should be three to one; where land is inexpensive, even five to one would be more satisfactory to a streamlined cross-section.

With well flattened slopes on streamlined highway cross-sections, considerably less lineal feet of guard rail construction would be required.

Not only will there be a saving of material vital to defense, but the amount of money thus saved will assist in the purchase of additional right-of-way necessary for the flattened slopes through cut and fill areas. Then too, much of the attractiveness of our roadside improvement is lost when fronted by endless borders of guard rail posts and wiring.

In certain areas it may be practicable, and certainly is more pleasing, to outline our plantings with rustic guard rail—red cedar posts and white cedar rails—where some protection about streams and gullies is required.

Many States already have excellent specifications for both types of rustic guard rail, that is, a low single log eighteen inches above ground, and a two-log rail three feet high where greater protection is necessary.

On practically level ground, we would suggest a minimum of 35 feet from curb to edge of right-of-way. Here it is assumed that 12 feet would provide adequate "sidewalk area" adjacent to and 8 inches above the shoulder. Where concrete curbing is not required, a sod berm may be constructed to tie in the lawn area of the sidewalk with the road shoulder. The remaining 23 feet to the right-of-way line would provide ample space for economical but efficient landscape practice to accomplish the effect desired—adequate screenage with natural roadside aspect.

In the cross-section of the ideal streamlined dual highway, with flattened slopes and indigenous plant materials fitting in with the adjacent land, we are concerned with the center island, its width and whether to plant therein trees or create simple grass areas. Upon the traffic needs of the territory involved and upon the width of the right-of-way possible to obtain, will depend the distance between opposing traffic lanes. An ideal minimum through rural districts would be twenty feet, enough to provide grass areas, easy and economical to mow, with possible tree plantings where they do not interfere with visibility. Such tree plantings in conjunction with the roadside landscaping serve three purposes:

To tie in the road proper with the adjacent roadside and landscape.

To afford relief from road glare and reflections.

To provide for a protective concealment of the highway.

Where a wider center island is possible and perhaps desired, especially on arteries having heavy commercial traffic, more extensive plantings are recommended. Still, these must be kept within bounds, otherwise maintenance costs will rapidly increase. Here, too, construction engineers must be consulted to the end that, in the enthusiasm of improving the appearance of the highway, the safety factor is not inadvertently left in the bcakground.

With reference to road glare, it has been said by many that the danger of reflections and of road glare occurring during daylight driving would be greatly lessened by shade tree plantings along our highways. This may readily be noted by the relief experienced when traveling in woodland country after having motored for sometime on a highway through treeless plains and open farm lands.

(Continued on page 22)

Source of Samples	Quantity Applied-Million Gallons per Acre	(Parts per Million) Ammonia Free	Ammonia Albuminoid in Solution Total	Ammonia Albuminoid in Solution	Kjeldahl Nitrogen in Total	Kjeldahl Nitrogen in Solution	Nitrogen as Nitrates	Nitrogen as Nitrites	Oxygen Consumed	Alkalinity Total	Alkalinity Caustic	Fats	Relative Stability	pH	B.O.D. Before Settling	B.O.D. After One-hour Settling	Suspended Solids Before Settling Total	Suspended Solids Before Settling Loss on Ignition	Suspended Solids Before Settling Fixed	Suspended Solids After One-hour Settling Total	Suspended Solids After One-hour Settling Loss on Ignition	Suspended Solids After One-hour Settling Fixed
Waste applied to Trickling Filter No. 710	1.	2.13	4.74	3.13	13.3	9.6	-	-	82	260	114	267	-	10.0	514	-	178	157	21	-	-	-
Effluent from Trickling Filter No. 710	1.	.63	1.98	1.47	5.8	-	1.18	.12	18	256	1	35	68	7.7	68	38	127	92	35	29	24	5
Per Cent Removal	1.	71.	58.	53.	72.	-	-	-	78	-	99	87	-	-	88	93	29	42	-	84	85	76
Waste Applied	1.5	5.47	4.97	3.70	13.8	10.3	-	-	89	310	76	514	-	9.3	610	-	123	107	16	-	-	-
Effluent	1.5	.68	1.96	1.57	5.6	-	.97	.04	21	263	0	17	56	7.7	62	35	33	29	4	18	16	2
Per Cent Removal	1.5	88.	60.	58.	74.	-	-	-	76	-	100	95	-	-	90	94	72	73	75	84	85	88
Waste Applied	10.	4.22	4.07	2.92	9.3	6.8	-	-	65	229	12	175	-	8.4	447	-	136	127	9	-	-	-
Effluent	10.	1.67	3.75	2.32	7.1	-	.10	.05	47	236	0	115	15	7.3	322	248	101	93	11	74	70	4
Per Cent Removal	10.	60.	8.	4.	24.	-	-	-	34	-	100	56	-	-	28	40	24	27	-	46	45	56

Operation of Trickling Filter with laundry waste: Average analyses.

A Study of Laundry Waste Treatment

By JOSEPH A. McCARTHY

Chief of Laboratory, Lawrence Experiment Station, Massachusetts Department of Public Health

Treatment by trickling filters and by coagulation and settling studied at the Lawrence Experimental Station, using different coagulants, and costs compared.

AN EXTENSIVE study of the treatment of laundry wastes by trickling filter and by coagulation and settling was made at the Lawrence Experimental Station during the year 1941, the results of which are given herewith. The liquid used was obtained by constructing a sump in the waste discharge line of a nearby laundry, a pipe from which brought a continuous supply to the station. As far as possible only fresh waste was used, but the strength of this varied with the volume of work at the laundry.

Treatment by Trickling Filter

Trickling Filter No. 710 was filled with 8 feet of clean 1½-2½-inch stone; and laundry waste as pumped, with no preliminary treatment, was applied to it at rates beginning with one million gallons per acre daily, afterwards increased to 1.5 million and later to 10 million. Although the pH of the raw waste ran as high as 11.0 and the caustic alkalinity as high as 1,000 ppm, the filter ripened quickly and soon showed a very high degree of purification. The effluent was relatively free of turbidity, practically all the caustic alkalinity was removed, and the grease content was reduced from 267 to 35 ppm. There was no accumulation of grease, and some nitrification was observed. The relative stability averaged 68% in the filter in four months of operation.

When the rate was increased to 1.5 mgad the effluent continued to show the same high quality. In fact, the percentages of removal were higher in most cases than at the lower rate, but the figures for the one million rate included the first month of filtration before the filter had become stabilized. There was still no accumulation of grease anywhere in the filter, the relative stability was 56%, and the appearance was very satisfactory.

The rate was then abruptly raised to 10 mgad. The filter handled this load for several weeks, but nitrification was almost completely checked and the relative stability dropped off rapidly. Some degree of purification was evident after three months, but grease began to accumulate in the upper part of the filter and it was evident that the load was too great. Then the top 2 feet of the filter was removed, washed, and replaced, and the filter is now being operated at 5 mgad. Sufficient time has not elapsed to warrant definite conclusions but it seems possible that filtration at this rate may be continued.

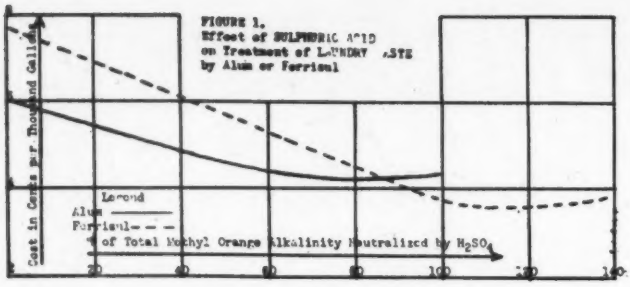
The work of this trickling filter is remarkable in view of the very high pH and the heavy load of grease applied—490 pounds per acre-foot per day while the rate was 1.5 million, and 1,800 pounds at the 10-million rate. There was no evidence from microscopical examination of bacterial growth different from that in a normal trickling filter.

Samples were settled one hour before analysis. The table gives the results of these analyses, and also shows the B.O.D. and suspended solids of samples before settling.

Treatment of Laundry Wastes by Coagulation and Settling

As a basis for the study of coagulation of this waste, a dozen runs were made with alum, fill-and-draw, using the amounts of alum indicated by preliminary jar tests. A dozen such tests showed an average alum requirement of 23 gpg, which reduced the average pH of the waste to 6.1. The floc settled very rapidly and, although most of the samples were collected after 2 hours' settling, this period could have been greatly reduced without materially affecting the results.

Later, continuous runs were made. Coagulant was added to the waste as it entered a circular 600-gallon tank at the rate of 12.5 gpm. The tank was equipped with a 4-blade paddle operated at 3 revolutions per minute. The detention period in the mixing tank was about 50 minutes. The waste then flowed continu-



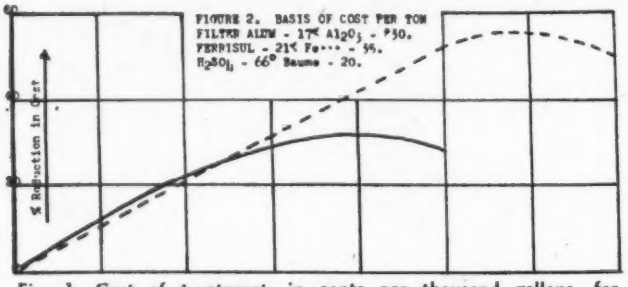


Fig. 1—Cost of treatment, in cents per thousand gallons, for different percentages of alkalinity neutralized.

Fig. 2—Costs per ton of chemicals used in estimating cost of treatment.

ously into a 4,500-gallon settling tank with under-and-over baffles, which gave a settling period of 6 hours. This proved longer than necessary, and the sedimentation period was reduced to 3 hours. The average amount of alum required was again 23 gpg and the pH was 6.3. The supernatant liquor produced was not quite as good in quality as with the fill-and-draw system but it was still a relatively clear liquid and showed a reduction of 89% in turbidity, 84% in fats, and 74% in B.O.D. One or two special runs, with continuous adjustment of alum feed, showed that it would be practicable with constant attention to increase these percentages much further.

Fill-and-draw runs with ferric sulphate (ferrisul) gave a supernatant slightly better than that produced using alum; the dosage required was, however, 32 gpg as against 23 for alum. The pH was reduced by the iron salt from 10.2 to 5.4.

It had been feared that difficulty in obtaining a low residual iron content might be experienced in the use of iron salts as coagulants. This work on laundry wastes, as well as similar work during the year on paper mill wastes, showed that the residual iron content could be maintained at about one part per million. As will be shown later, this low residual content can not be obtained without very close control.

The sludge produced from the alum experiments was very high in organic matter, averaging 41% in fats and 74% loss on ignition; the sludge from the iron salt was similar, showing 44% fats and 76% loss on ignition. In spite of this, the sludges dried rapidly and, probably because of the alum or iron content, were not at all putrescible. They gave every indication of being easily handled on either pressure or vacuum filters.

Further Experimental Work on Coagulation

It had been demonstrated that this laundry waste could be coagulated, using either alum or ferric salts, to give a satisfactory effluent, often with reductions of 90% or more in B.O.D., turbidity, and fats, and of 75% or more in oxygen consumed.

It was found that the use of sulphuric acid in conjunction with either alum or ferrisul greatly reduced the cost of treatment. It was found that acid could be added to the waste either before the addition of alum or at the same time. In the use of ferrisul, however, it was found necessary to add acid first, and not to add the iron until the acid had become mixed with the waste. With alum, best results were obtained when about 80% of the methyl-orange alkalinity was neutralized by acid and alum was then added to produce optimum clarification. With iron, it was found necessary to neutralize all or nearly all of the methyl-orange alkalinity, or even to add excess acid up to 20%, before adding the optimum amount.

By this procedure, as much as 70% of the alum requirement can be saved, with an overall cost reduction of 32%. Eighty to 90% reduction can be made in the amount of ferrisul with a total cost reduction of 55%. Alum without acid was found to be cheaper than ferrisul without acid, but when acid was used, the iron plus acid gave lower costs than alum and acid or alum alone. The removals obtained with acid compared favorably with those obtained from either alum or iron alone.

The costs are shown in Figures 1 and 2. It is evident that, when either more or less than the specified amount of acid is used for neutralization, the cost increases. The highest costs were found when no acid was used.

Figure 3 shows the effect of acid on the optimum pH value for best clarification, with corresponding reductions in the dosage of coagulant. The most economical results were obtained with alum and acid at a final pH between 4.5 and 5.0; or about the neutral point of methyl orange. A pH value between 3.0 and 3.6 gave the lowest costs with iron and acid.

When ferric iron alone was used, the best and cheapest results were obtained with a final pH between 5.0 and 5.6, and with alum alone, the optimum pH range was from 6.0 to 6.5.

From the standpoint of economy as well as that of efficiency it was shown that sufficient coagulant must be used to obtain complete clarification. The use of less than the optimum amount gave not only poor results but also poor economy. Figures 4 and 5 show these results.

If iron alone was used, it was shown to be imperative that the optimum amount of coagulant be employed. Amounts less than optimum gave tremendously

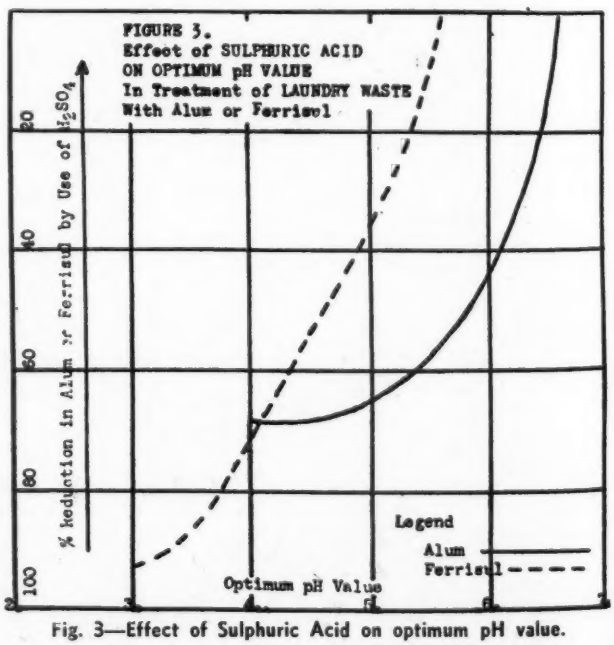
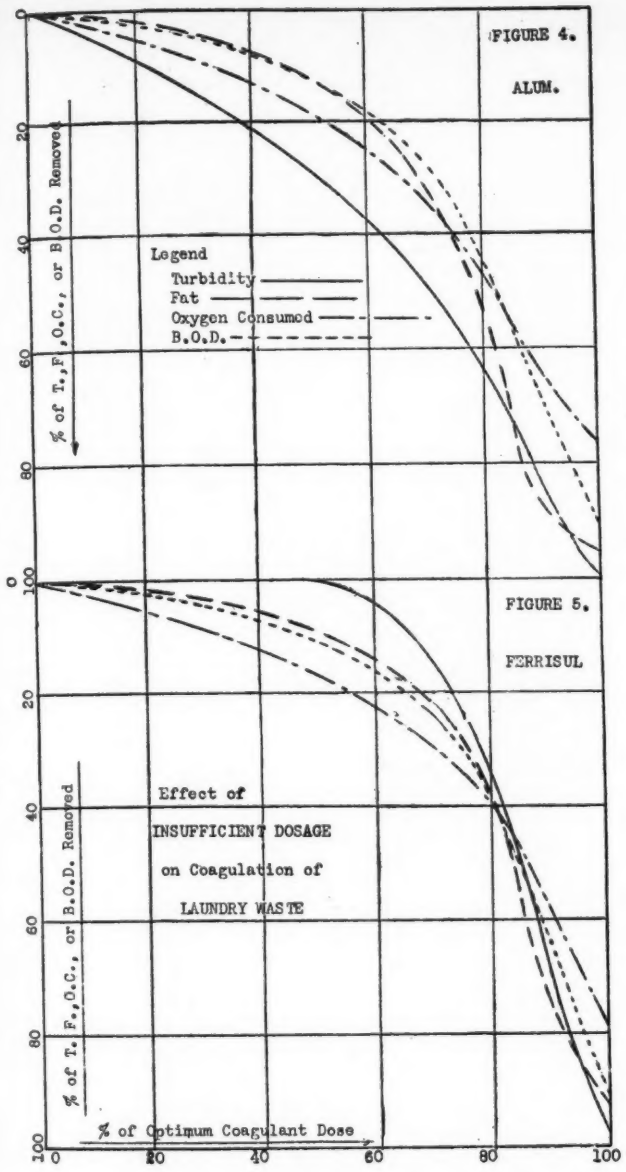


Fig. 3—Effect of Sulphuric Acid on optimum pH value.



Figs. 4 and 5—Effect of insufficient dosage of alum and of ferrisul, respectively.

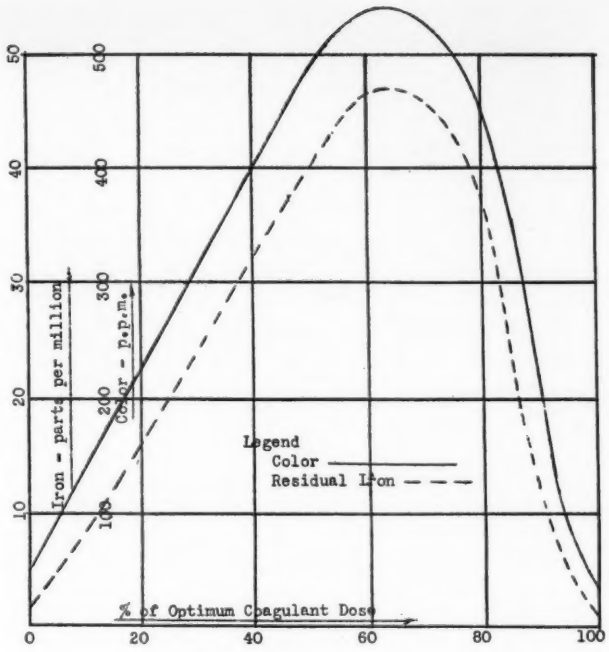


Fig. 6—Effect of partial dosage with iron.

increased color and residual iron. The effect of partial dosage is shown in Figure 6.

The use of excess iron affected the results much less. The following table shows the effect of excess iron:

Ferrisul—grains per gallon.....	50*	55	60
pH	5.5	4.8	3.9
Residual iron, parts per million.....	1.2	2.4	7.6
Color, parts per million.....	10	15	30

*Optimum

The effect of excess alum was less serious. No increase in color was observed and, except in occasional circumstances, residual alum would not be objectionable in most streams.

There was a tendency toward higher residual iron and lower removal of fat when the methyl-orange alkalinity was completely neutralized by acid, espe-

(Continued on page 38)

Coagulation of Laundry Wastes: Average Chemical Analyses

Sample	Coagulant, Grains per Gallon	(Parts per Million) Turbidity	Kjeldahl Nitrogen Total	Kjeldahl Nitrogen Solution	Oxygen Consumed	Fats	Alkalinity Methyl Orange	Alkalinity Phenolphthalein	B.O.D.	pH
Alum, continuous operation										
Raw waste		310	11.5	8.8	75	266	226	115	550	9.7
Coagulated and settled	23	34	4.6	3.7	18	41	80	0	143	6.3
Per Cent Removal		89	60.	58.	76	84	62	100	74	-
Alum, fill-and-draw										
Raw waste		322	12.6	9.4	75	253	245	88	551	9.6
Coagulated and settled	23	13	6.4	4.2	17	22	64	0	84	6.1
Per Cent Removal		96	49.	55.	77	91	74	100	85	-
Ferrisul, fill-and-draw										
Raw waste		344	13.0	9.6	101	319	265	103	518	10.2
Coagulated and settled	32	9	5.0	3.3	23	17	16	0	35	5.4
Per Cent Removal		97	61.	66.	77	94	94	100	93	-

Courtesy Littleford Bros.

Use of a kettle with hand spray in doing patch work.

Street Maintenance

THE methods of making patches in bituminous streets are fairly standardized—clean out the hole, cut the edges square, paint with bitumen, fill the hole and roll or tamp. However, it is believed to be worth while to describe in some detail and with some repetition the methods used by a number of communities in various parts of the country.

L. R. Plemmons, city engineer of Hot Springs, Ark., gives the following directions, which are typical of practices in that state: Trim the edges and square them up; clean the area thoroughly and paint with asphalt; place the patching material and tamp or roll; then cover with sand. Small patches are not rolled. In general, premixed material is used for patching, this being premixed in a bituminous mixer.

California.—City engineers of 45 cities in California sent information in regard to patching methods. Of 32 cities using pre-mixed material for patching, 20 purchase this from commercial plants and 12 mix their own, mostly in bituminous mix plants. In compacting patches, 36 cities use rollers, 5 use rollers only on the larger patches, and 2 do not roll patches. For rolling, 19 cities use standard rollers, 10 use portable rollers, 4 use both or either and 6 use special rollers or trucks, sometimes with special tires.

At Hermosa Beach, Chas. F. Saunders, city engineer, uses the following: Clean, trim, paint with Bitumuls emulsion, and patch using premix stock pile material which costs us $2.55 per ton delivered at our yards. C. L. Dimmitt, city manager, Redwood City, gives the following directions: (1) Determine whether it is a base or surface failure; (2) remove defective portion; (3) clean out area thoroughly; (4) spray with emulsified asphalt; (5) fill in with new material; (6) roll. V. L. Martin, assistant engineer, Santa Rosa, uses Bitumuls and coarse aggregate to build up patches for deep holes, surfacing with plant mix.

Colorado.—Of 7 cities reporting on methods, 5 roll patches and 2 do not; only one city uses a portable roller. All use premixed material; 3 mix this in bituminous mixers and 3 use concrete mixers. James D. McGillis, city engineer, Grand Junction, gives these directions: (1) Try to determine the cause of failure; (2) remove the cause, if possible; (3) remove all mud and unstable soil and base; (4) rebuild the damaged portion, using dry and substantial materials; (5) seal coat patch and surrounding pavement.

Connecticut.—Seven Connecticut cities reported on detail methods. Of these, 5 roll patches and none use portable rollers. Practice in patching is well standardized. Torrington, W. F. Nierintz, city engineer, uses premixed asphalt concrete with ½-inch trap rock as the base. The hole is cleaned, roughed, brushed out and painted with asphalt; the asphalt concrete is then placed and the patch rolled. Waterbury, C. A. Root, city engineer, uses a material like the original surface for streets with permanent bases; on others, amiesite or other cold mix is used.

Courtesy Koppers Co.

Filling patch with Tarmac CP mix.

Idaho.—R. W. Neyman, city engineer of Wallace, emphasizes the need for thoroughly dry contact surfaces. The subgrade is examined and compacted; the edges of the patch are cleaned with gasoline; usual procedure follows.

Illinois.—Reports on patching practices were received from 14 cities. Of these 10 roll all patches, 2 roll only larger ones, and 2 tamp; 5 use portable rollers, 6 use standard rollers, and 1 uses a truck. The following procedure is used by Allen L. Fox, city engineer of Blue Island: After cleaning and cutting back, go down to solid material; clean thoroughly; dry; prime with hot bitumen; apply binder and top; roll or tamp to an even surface. Lowell D. Kerby, city engineer of Danville, emphasizes the necessity of examining the base or subgrade and properly repairing this if it is faulty. At Lincoln, Conrad Miller, city engineer, uses rock asphalt for patching bituminous concrete surfaces. M. H. Kinch, city engineer of Urbana patches with the same material as was used in the original construction.

Indiana.—Seventeen cities submitted data: 11 roll patches; 4 do not roll; 2 roll large patches but tamp small ones; 6 use standard rollers and 6 use portables. Charles W. Childs, city engineer of Franklin, stresses the need for thoroughly cleaning and drying the holes before patching. E. D. Canatsey, city engineer, Martinsville, follows this procedure: Brush holes clean, trim, spray with hot TM1, fill with suitable stone (No. 11), spray again and cover with fine stone (No. 12). W. E. Morthland, city engineer of Valparaiso says: "In spots indicating base weakness,

ractices—Patching Bituminous Surfaces

Scores of engineers in all parts of the country tell in detail how they patch bituminous pavements of all kinds, and what equipment they use.

rebuild the base. Skin patches are made with a pressure distributor; deeper holes are filled with premix prepared at the barn in a concrete mixer."

Iowa.—From this state, 10 cities forwarded data; 7 use rollers on patches, of which 2 use portable rollers. Dubuque, Paul A. Rossiter, city engineer, uses a mix of RC-3 asphalt and ⅜-inch stone as a cold patch material for oiled macadam, and a fluxed prepared asphalt mix for asphalt streets. Standard practices already described are generally observed.

Kansas.—Of 7 cities, 4 roll patches; 2 use portable or small rollers. In Abilene, Walter F. Johnson, city manager, weak places are cut out, the earth beneath is thoroughly compacted and a 6-inch concrete patch is placed where needed and covered with 1½ inches of asphalt. In El Dorado, H. E. McMillen, city engineer, thin or broken edges are cut back and then painted with RC-2 asphalt; a cold patch mix is then placed and rolled; and 48 hours later a seal of RC-2 is placed

Maryland.—In Takoma Park, William F. Fischer, Sup't of Public Works, follows this practice: Remove all loose material, clean thoroughly with a broom, paint the edges and the bottom with hot asphalt, fill with cold patch and roll with a 3 to 5-ton roller.

Massachusetts.—Reports on patching procedures were received from 26 cities; 18 roll patches; 7 do not; and one can take it or leave it alone; 9 use portable rollers. Frederic C. Holmes, Sup't of Streets of Lee, outlines what appears to be pretty general practice in the state as follows: Cut out holes to a sharp outside edge, enlarging if necessary to reach firm and undamaged material; sweep clean and patch, very shallow holes are painted, but not deep ones. New Bedford, Edward T. Hodson, Com'r of Public Works, uses cold mix for temporary repairs and a hot plant mix for permanent patching. Cornelius W. Phillips, Superintendent of Streets, Springfield, writes: Patches should be cut out square or rectangular to the full depth of the pavement. For hot mix patches, the squared edges are painted with hot cutback, filled with the same mix as the existing pavement, and rolled.

Courtesy Littleford Bros.

Utility spray tank for hand spraying a repair job.

Courtesy Austin-Western

Shoulder trencher cutting trench for widening road.

Michigan.—Data were received from 13 cities; 10 roll patches; 4 use portable rollers. In Ann Arbor, Geo. H. Sandenburgh, city engineer, the old material is removed and the holes cleaned to the base with air tools and the base is carefully primed; plant-mix material is then placed and compacted with a tandem roller. Iron Mountain, George Wallner city engineer, follows Tarvia's KP directions in detail. R. A. Trebilcock, city engineer of Norway, says: "Pick out clean, tamp crushed rock in hole, apply tar and allow to penetrate; throw on chips, add tar and tamp." General practice in Michigan appears very good.

Minnesota.—Reports were made by 17 cities; 8 roll patches and 8 do not, while one may do either; 6 use portable rollers. Caledonia, Abner Houge city engineer, uses ½ sand and ½ pea gravel mixed with hot RC-2 asphalt for filler. O. C. Helseth, city engineer of Crookston, cuts out base 9 ins. deep, refills with gravel and sand, tamps, paints the edges of the old surface with cut-back, fills with bituminous material and rolls; seals with RC-3 next year.

Mississippi.—H. R. Covington, city engineer of Canton, says: "We first try to bring the base of the failed area up to the standard of the remainder of the area, and then patch."

Missouri.—Richard D. Fowler, city engineer of Jefferson City, cuts the sides of the patch clean and vertical to the full depth of the pavement, and uses material of the same type and grading as that of the original. In all, 12 cities reported.

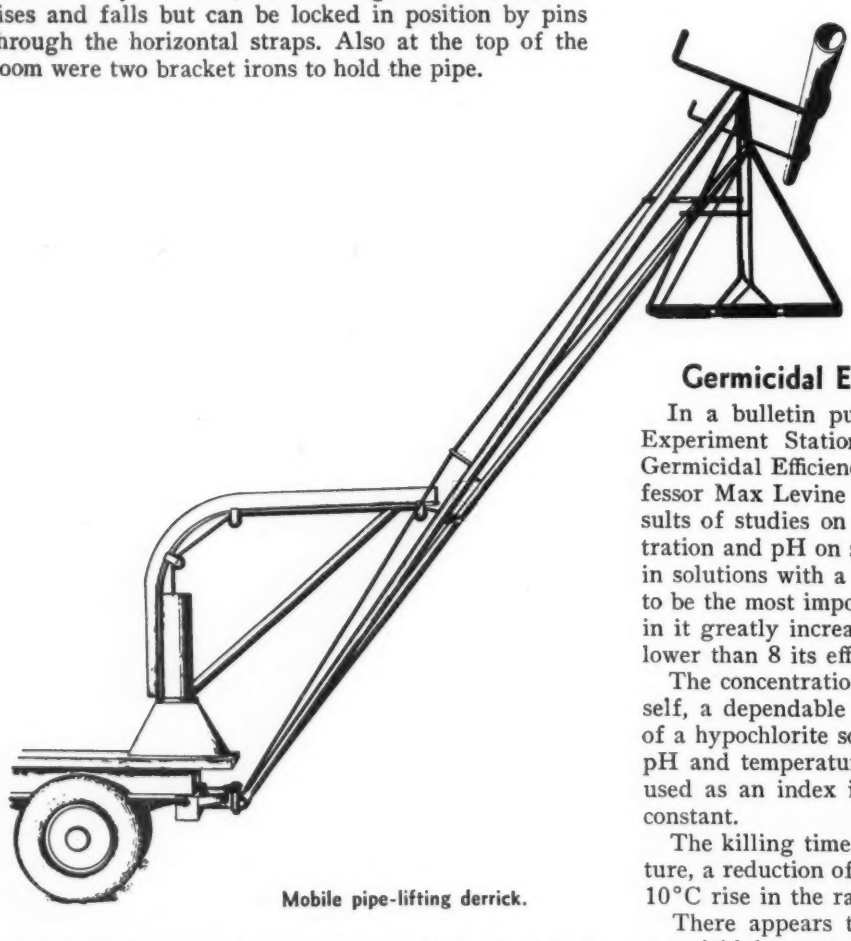
(Continued on page 29)

Hanging a Water Main Under a Bridge

By H. M. NEIGHBOUR
Water Superintendent, Santa Ana, Calif.

WHEN the State Highway Dept. built a concrete bridge across the Santa Ana river to replace a trestle washed out in the 1938 flood, they left openings in the tops of the piers, just under the floor, through which we could run a 6" water line, and placed strap hangers, suspended from the deck, between the girders and above their bottoms, for supporting the pipe, which hung about 18 ft. above the ground.

The bridge was about 500 ft. long, and to build scaffolds for placing this long line of pipe would have been quite a chore, so I conceived the rig shown in the accompanying sketch and built it in the city machine shop. We already had a crane which we had erected on the rear end of a truck, which is operated by a winch with power taken off from the truck engine. Just below this crane we fastened a boom which was raised and lowered by the crane and swung horizontally around its base. At the top of this boom was suspended a platform to carry two men, which swings free as the boom rises and falls but can be locked in position by pins through the horizontal straps. Also at the top of the boom were two bracket irons to hold the pipe.



Mobile pipe-lifting derrick.

To place a pipe, the boom was lowered to the ground and a length of pipe placed in the brackets. Then the boom was raised and swung until the pipe could be slipped into the hangers, then swung enough further to bring it in exact position at the joint, when the joint was made and the boom lowered for another pipe. Six men, including truck driver and foreman, completed the job in three days.

Dowelling Dummy Joints in Concrete Pavement

Although the method of dowelling with round bars so far used in Germany has undergone many improvements since the beginning of concrete road construction, it still has the disadvantage that the framework must first be assembled on the site. A method is described for dowelling dummy joints that consists in using a stamped metal insert with pierced horizontal flanges projecting from the upper edge on alternate sides. The lower edge is flanged on one side only, and short tongues of metal project vertically from its upper surface. A short section containing a single group of flanges has been found capable of carrying a vertical load of at least 990 lb. (450 kg.); the corresponding load for the entire insert (about 12 ft. long with 24 + 25 flanges) is about 10½ tons (10,800 kg.). Satisfactory results were also obtained in dynamic tests in which the thrust was applied in the direction of the road axis. In construction, the insert is laid on the formation, the concrete is placed, and the groove of the joint cut out subsequently in the usual way. By using dowels of this type an economy in steel of about 40 per cent is possible, in addition to a considerable saving in wood, bitumen, wire and sawdust: this almost offsets the slightly higher cost of the metal insert. In addition, the joints are very easily installed and there is a corresponding saving in manpower. It is also claimed that the distribution of stresses is greatly improved. The possibility of corrosion may be obviated by the use of copper-bearing steel. — *"Road Abstracts," from "Betonstrasse."*

Germicidal Efficiency of Hypochlorites

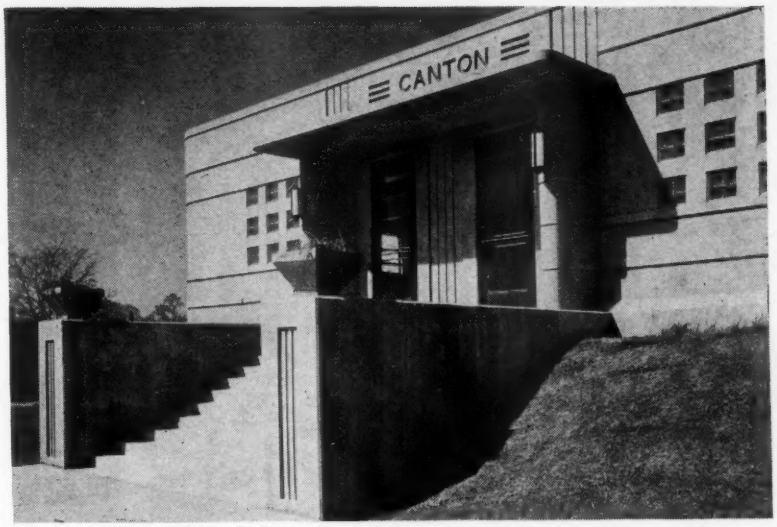
In a bulletin published by the Iowa Engineering Experiment Station entitled "Factors Affecting the Germicidal Efficiency of Hypochlorite Solutions," Professor Max Levine and A. S. Rudolph present the results of studies on the effects of temperature, concentration and pH on such efficiency. They concluded that in solutions with a pH higher than 8, the pH appears to be the most important single factor, slight increases in it greatly increasing the killing time. If the pH is lower than 8 its effect is distinctly less marked.

The concentration of available chlorine is not, in itself, a dependable index of the germicidal properties of a hypochlorite solution if other factors, particularly pH and temperature, are not constant; but it may be used as an index if the other factors are maintained constant.

The killing time decreases with increasing temperature, a reduction of 40 to 60% being obtained for each 10°C rise in the range from 20° to 50°C.

There appears to be a time lag during which the germicidal agent penetrates the cell, followed by a death phase in which the agent is reacting with the cell constituents. Differences in killing time appear to be associated primarily with differences in penetration rate; which in turn seems to be associated with the concentration of undissociated hypochlorous acid, which therefore is a most significant factor in disinfection with hypochlorite.

Some Water Works Practices in Small Communities



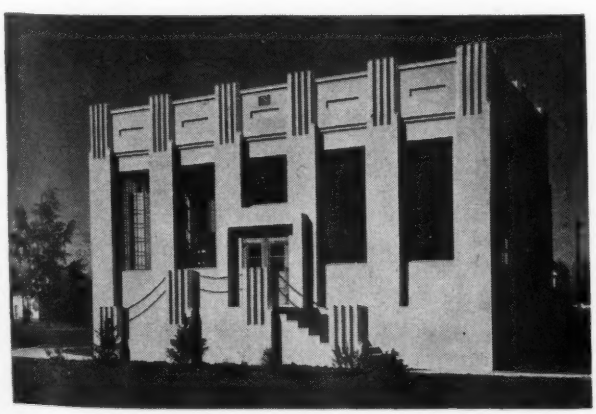
Many small waterworks plants are very artistically housed. Above is the building at Canton, Ill., population 12,000. Below is the one at Hallock, Minn., population about 1,500.

INFORMATION has been collected by PUBLIC WORKS from 602 small communities concerning their practices in several features of water works operation. These villages and towns form a cross-section of small community practice throughout the United States. Reports were received by states as follows:

Alabama, 12. Arizona, 4. Arkansas, 10. California, 23, Colorado, 3. Connecticut, 3. Florida, 5. Georgia, 19. Idaho, 6. Illinois, 47. Indiana, 24. Iowa, 35. Kansas, 18. Kentucky, 10. Louisiana, 4. Maine, 3. Maryland, 1. Massachusetts, 15. Michigan, 11. Minnesota, 25. Mississippi, 7. Missouri, 14. Montana, 2. Nebraska, 12. New Hampshire, 3. New Jersey, 12. New Mexico, 3. New York, 55. North Carolina, 17. North Dakota, 3. Ohio, 34. Oklahoma, 20. Oregon, 4. Pennsylvania, 32. Rhode Island, 4. South Carolina, 6. South Dakota, 4. Tennessee, 6. Texas, 30. Utah, 11. Vermont, 3. Virginia, 11. Washington, 10. West Virginia, 5. Wisconsin, 16.

Free Water for Schools, Hospitals and Public Buildings

Schools.—Of 511 villages and towns replying to this question, 83 furnish free water to schools, while 428 charge for the water. While there are one or more places in practically every state furnishing free water, Georgia is the outstanding example, with 18 of the 19 reporting communities not charging. California's 18 reporting communities all charge schools for water; so do 43 of 47 in New York State; and 27 of 28 in Ohio. Illinois votes 36 to 8 for charging. Alabama is 5 to 2 for free water for schools.



Hospitals.—Practice is even more unanimous in regard to hospital water supply, 374 communities out of the 423 answering this question reporting that they do charge hospitals for water. There are a scattering of generous communities in almost every state, but New York with 9 communities of 47 replying, leads in this benefaction. Georgia reverses its stand as regards schools. Of 28 Texas towns, 4 do not charge hospitals for water.

County and State Buildings.—Apparently there is little love lost between communities and their states, at least so far as free water is concerned. Of 441 towns and villages replying, only 32 do not charge the state or county for water used in their buildings. New York, Ohio and Indiana are solidly against it; in Illinois, only 1 of 37 communities provides free water; Georgia is most generous, with 4 of 17 so reporting.

Municipal Buildings.—When it comes to taking money from one pocket and putting it into another, that is, in charging themselves for water used in municipal buildings, the situation is quite the reverse, as 353 out of 488 do not charge for water for municipal buildings. Wisconsin is quite an exception to the general rule, only 1 of 14 communities providing free water. New York is 37 to 9; Ohio, 29 to 1; Illinois, 24 to 16; California, 11 to 7; Iowa, 31 to 3; Texas, 24 to 6; and Georgia 16 to 2.

Percentage of Water Used for Public Purposes

The communities reporting on this question numbered 318. Of these, 90 reported that less than 5% of the water consumption was used for public purposes. Those reporting more than 5%, but less than 10% numbered 84; those with more than 10% but less than 20% were 78. Thereafter the number fell off quite rapidly, with only 29 reporting public usage more than 20% and less than 30%; 15 more than 30% and less than 40%; and 22 using more than 40% for public purposes.

An accompanying question in regard to payment was not clearly understood, but it appears that about 126 of the 318 received payment for the water, either in cash or by book credits.

Percentage of Water Sold and Accounted For

In response to the question as to the percentage of water sold, 6 communities reported that less than 50% was sold and paid for. Of the remaining 375 replying to this question, 20 reported selling more than 50% but less than 60% of the water; 27 sold more than 60% but less than 70%; 37 sold between 70% and 80%; 53 sold between 80% and 90%; and 238 sold more than 90% of the water supplied.

It is well known that not all small communities have facilities for measuring the water supplied by them to the distribution system, though nearly all are well metered, as will be shown later. Therefore it is not surprising that the replies above do not agree fully with those stating the percentage of the total consumption that is unaccounted for. Only 30 communities said that more than 95% of the water consumed was accounted for; 40 said that 90% to 95% was accounted for; 65 accounted for 80% to 90%; 37 accounted for 70% to 80%; 67 reported other varying figures below 70%.

Percentage of Services Metered and Water Consumption Per Person

Of 482 communities reporting on the percentage of services metered, 377 stated that they were over 90% metered; 20 were between 80% and 90%; 16 between 70% and 80%; and 69 were less than 70% metered. Of the 69, 36 reported less than 10% metered.

About two-thirds of the communities reported per capita water consumption. Consumption greater than 120 gallons per person per day was reported by 10 of the 17 cities reporting less than 10% of services metered; but by only 36 of the 214 cities reporting more than 90% of the services metered. Of 271 communities (of which 214 were more than 90% metered), 170 reported a consumption of less than 50 gallons per person.

Frequency of Testing Meters

Statements as to frequency of testing meters were made by 382 communities. Very little uniformity in practice is indicated. Of the 382, 48 reported that no tests were made; 26 make tests on request; 33 at 5 year intervals; 41 at 2, 3 or 4-year intervals; 63 annually; 39 at less than yearly intervals; 51 at "no regular time"; and the remainder "on complaint," "as needed," "when out of order," and at similar irregular periods. The modern water meter is a marvelously reliable and accurate machine, but it does require some attention, checking, testing and repairs.

Testing and Sterilizing New Mains, and Mapping Distribution Systems

Testing new mains and extensions for leakage before use or acceptance is a rather widespread practice —more so than the Editor had supposed, considering the small size of most of the communities involved. Of 430 towns and villages reporting on this practice, 395 stated that new mains and main extensions were tested for leakage after laying.

The record is not quite so good in regard to sterilizing these mains before using them, the reports standing 276 to 147 in favor of sterilizing. As might be expected, those states with strong and capable sanitary engineering departments show better than average. No big state shows up 100%, but Illinois is 23 to 11, Iowa 22 to 6, New York 31 to 13, and Texas 22 to 5.

Also unexpected was the reply to the final question in this group—"Have you an accurate map of your water distribution system?" To this, 391 stated that they did have such a map and 92 reported that they did not. It would be interesting to know how many of these accurate maps resulted from WPA projects.

Methods of Treatment

Of 601 returns (all of which did not answer in full), 176 of these small communities reported filter installations; 58 report that they soften the water; 77 state that aeration is employed; 92 use activated carbon (but there is no information on how or how much); chlorination is reported by 290.

Georgia communities report 11 filter plants and 5 softening installations; New York 15 filter plants, Ohio 16 and Illinois 20. Illinois and Ohio lead in softening plants with 10 and 12 reported.

These figures are, of course, not complete, but they do indicate trends. For instance, the fact that 32 New York and 28 Illinois communities report chlorination is an indication that the necessity for safeguarding the water supply is appreciated.

Frequency of Billing, and Discounts

Almost exactly half of the communities reporting send out bills monthly—245 out of 495. Alabama, Arkansas, California, Georgia, Oklahoma and Texas are among the states where this practice of monthly billing is universal. Billing at quarterly intervals is almost as highly favored—201 as compared to 245. Michigan and Wisconsin communities all report quarterly billing; Iowa, Ohio and Pennsylvania are strongly in favor of this also; while Illinois and Minnesota have no settled practice. Quite a proportion of the reports from New York and a smaller number from Ohio and Massachusetts favor semi-annual billing. Annual billings are reported by 7 communities.

Of 504 communities reporting, 205 state that they allow a discount for prompt payment while 299 do not allow a discount. However, many of these charge a penalty for payment after a certain date and this method is, in effect, a discount system.

Where a discount system is in use, 10 days is the discount period provided by 119 communities, while 48 allow 15 days. 18 allow 20 days and 20 allow longer periods. Of 45 New York State communities, 17 reported semi-annual billings. It is therefore rather to be expected that a longer discount period (10 New York communities reported 30 days) would be granted.

How effective is the discount period in getting customers to pay promptly? Of the 205 places reporting, 129 state that over 90% of the customers pay within the discount period; in 56 other communities, between 80% and 90% of the customers do so; in 8 places less than 50% of the creditors settle on time. These places are so widely scattered as to indicate no special significance.

Specifications for Paper for Curing Concrete

At the annual meeting in June of the American Society for Testing Materials, Committee C-9 recommended that specifications for waterproof paper for curing concrete provide that the paper "shall consist of two sheets of plain kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions of the paper, not more than 1¼ in. apart. The paper shall be light in color, shall be free of visible defects, and shall have a uniform appearance."

Section of old brick sewer showing crack in top and liner pipe grouted in.

Corrugated liner pipe being threaded into brick sewer. Left—John H. Barth, City Engineer. Right—Carl Waldstrom, Supt. of Sewers.

Relining of An Old Brick Sewer

By JOHN H. BARTH
City Engineer, La Crosse, Wis.

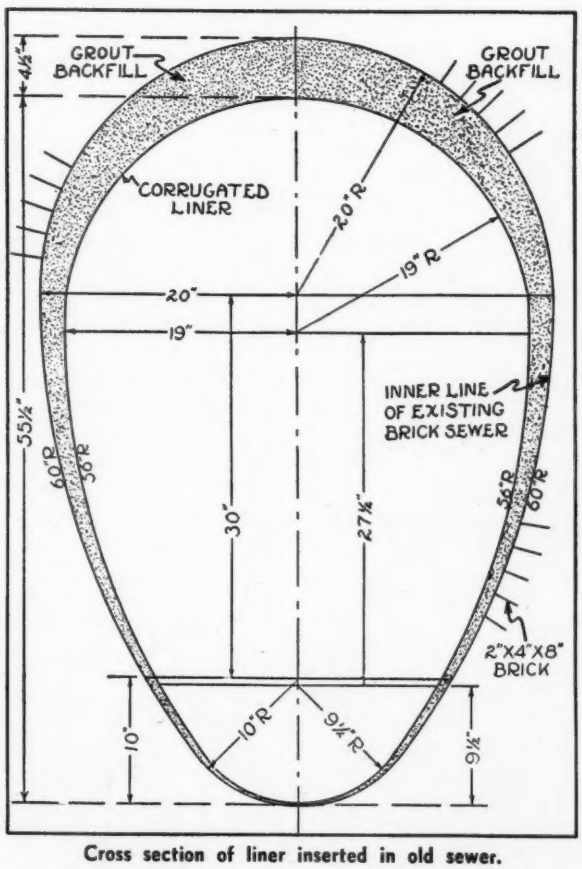
An egg-shaped sewer, nearing collapse, was made "good as new" by lining with corrugated metal, and without digging up the street.

THE main outfall sewer for La Crosse, Wis., is an old two-ring 40″ x 60″ egg-shaped sewer, carrying combined sewage. It had given good service for 50 years, but when a new bridge was built across the Mississippi river, which directed all the traffic over Cass street (in which this old sewer was laid), it seemed wise to inspect the sewer to learn whether it would safely carry the additional load. The inspection showed that the sewer was badly cracked on the top, with roots growing through in many places, and the bottom was badly eroded, one ring of brick being completely gone in many places.

This sewer, being the main trunk for both storm and sanitary sewage, could not be relaid as it was not economical to divert the flow. After careful study of different methods, it was decided to reline the sewer, using Armco galvanized corrugated metal pipe, coated with asphalt which contained asbestos. Since the sewer had to remain in service while repairs were being made, the job could best be done in winter, when there was no danger of storm water.

In order to determine the maximum size of liner that could be used, a wooden template was made, so arranged that the size could be reduced by successive operations until it could be got through the sewer. By this means it was found that a liner could be fitted that would lose only 4 inches at the top and one inch across the sides, fitting snugly at the invert. (After the job had been completed it was found that the velocity of flow was so increased that the reduction in size had little effect on the capacity of the sewer). Liner pipes of this size and shape were made in 14-foot sections and were so arranged that they could be bolted together by means of flanges and bands.

To install the liner, an open pit was excavated in the center of the job down to the sewer, which was 20 feet deep. This pit was made 18 feet long, to allow easy lowering of the liner. The top of the brick sewer was then removed to allow room for the 14-foot liner.



Cross section of liner inserted in old sewer.

The sides of the ditch at the bottom were then cemented from the sewer to the sheathing. The material excavated being all sand, this was necessary to protect from wash in case of high water.

The liner was lowered into the sewer by means of an ordinary tripod derrick. For moving the liner into the sewer we had a device made of angle iron which had one wheel on front and two in the rear, these being small pneumatic wheelbarrow wheels. The pipe was jacked up on this frame so that the wheels carried the entire load, when three men could easily push it along the sewer. (One tire was punctured by a tack and when the tire was repaired it was found that it had picked up many tacks.)

The liners were all lowered and placed during the night shifts. After a liner section was in proper place, it was bolted and locked into position. All lateral house connections had been carefully located beforehand, and a hole opposite each was cut into the liner, and a metal collar with a short stack was inserted and fastened in place with self-threading bolts.

The following day shift filled the space between the liner and the brick sewer with a cement mortar grout of a 1:2 mix. Compressed air was used both to mix the grout in the machine and then to force it into place. This grout filled all the cracks in the old sewer as well as the space between the liner and sewer.

The city contracted for the liner pipe delivered to the job, and the city sewer forces did all other necessary work of installing and grouting the liner. Itemized costs were as follows:

1,318 ft. of Armco liner	$12,692.00
182½ bbls. cement	464.50
157 cu. yds. sand	133.40
Rental of equipment and misc. supplies	503.50
Labor—City forces	2,570.00
Grand Total	$16,363.40

This made the cost of the liner $12.40 per foot. The job was completed in 40 working days, and traffic was detoured only the one block where the pit was dug. This cost was considerably less than that of replacing the sewer by either open cut or tunnel construction, even if this had been feasible.

The work was carried on under the supervision of the writer and Carl Wahlstrom, Superintendent of Sewers, with city forces, and with city equipment except for the grout gun, pipe-frame liner carrier, and the acetylene cutter for cutting in the house sewers, which were furnished by the liner contractor.

The job was divided into three sections, to be done a section each year. The last and completing section was installed this winter. The repaired sewer should give the city at least 50 years of additional service at a very nominal cost.

Economical Landscaping of State Highways

(Continued from page 12)

On the roadside, the area upon which the appearance of the highway depends, we must provide for an economical and yet adequate landscape planting, whether of seeding, strip-sodding, soil-binding small shrubs and vines, or trees and large shrubs; must treat relatively level areas, as well as cuts and fills, so as to prevent soil erosion to the best of our ability, and at the same time harmonize our plant materials and their arrangement with the existing landscape.

In order satisfactorily to turn over a roadside improvement project for economical maintenance, economy must begin with the starting of construction—even with the inception of the plans. Provision must be made for proper stockpiling of all available topsoil at convenient locations. The topsoil must be kept from eroding and free from the ever present weed growth. It may be possible to salvage sod, commercially satisfactory for strip-sodding or sod-curbing; while through land offering native plant material, preliminary surveys may provide sufficient trees and shrubs to form a nucleus for roadside landscaping.

In this preliminary survey, it is suggested that the landscape engineer go over the cross-section throughout each particular job with the contractor for grading that job. All trees, shrubs and ground-cover material within one foot of grade, between curb and right-of-way line, that it is practicable to leave untouched, may be marked. Between curb lines, plants suitable for salvage must be immediately transplanted. The contractor can then clear off the remaining growth and grade as close as possible to the material to be left standing. Naturally, with other established highways to maintain, the landscape crew in any particular district may not be able to operate at once on this new alignment, but the paramount idea is at least accomplished; that the roadside is bordered with native plant material, undisturbed on State-owned land, ready for economical and proper landscape practice.

In each State there are hundreds of trees, shrubs and vines indigenous to the country through which the proposed highways will extend. A number of these plants can be found growing in most of the Northeastern States. Varieties of oak, maple and gum, together with the sycamore or buttonball, are prevalent, while common honeysuckle as a ground cover can be found growing wild and abundant practically everywhere. It is generally known that each State has within its boundaries, nurseries which can supply carefully grown native plant material in quantities sufficient to supply highway department needs. In addition, each landscape division can, with moderate cost, collect from landowners adjacent to the proposed highways choice field-grown specimens of native stock to augment that purchased from the nurseries. Thus, by an early study of new alignments, by the cooperation with construction engineers, by salvage of all available material within the graded area between curb lines, and by planting with future maintenance in mind, we can greatly lessen our improvement costs and achieve the economical landscaping of our highways.

In a general way, I have tried to show the methods that should be used for economical and efficient roadside improvement of State highways by which the following results may be attained:

1. Stabilization of cut and fill slopes by streamlining and reduction of soil erosion.

2. Maintenance cost reduction by tree, shrub and ground cover plantings on areas adjacent to bridge abutments and on steep slopes where otherwise handmowing would be necessary for proper maintenance.

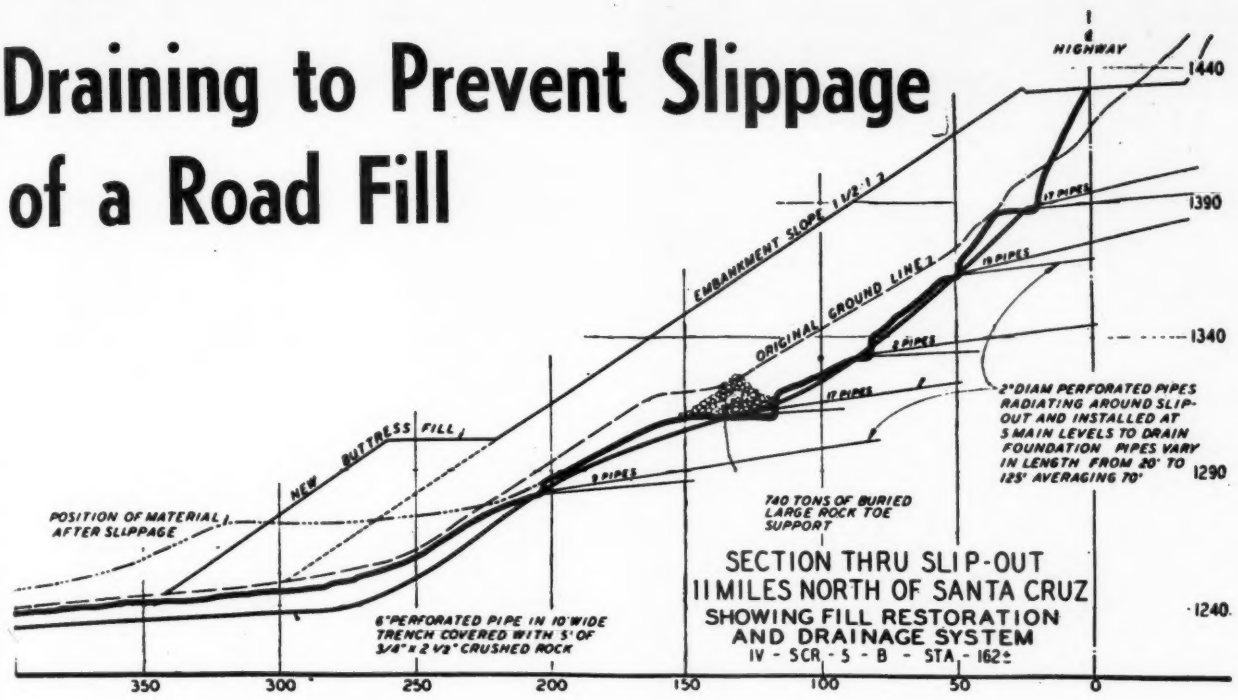
3. Natural landscape effects to screen out undesirable roadside blemishes.

4. Improved roadside appearance to heal construction scars and to reduce reflections and road glare.

5. Remote and well screened locations for "spoil areas" and "borrow pits" or the effective transformation of them to improve the landscape.

6. Protective concealment, where possible, of highways vital to defense.

Draining to Prevent Slippage of a Road Fill

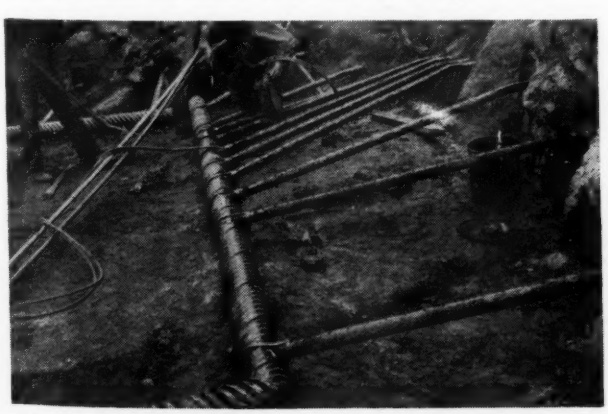


A side-hill road embankment 200 ft. high slipped down and out due to underground water. To prevent recurrence, over 4,500 feet of drains were placed under the 55,000 cu. yd. of new fill.

ACCOMPANIED by a roaring sound that resembled that of a major earthquake, two large dirt and rock fills on the Los Gatos-Santa Cruz Highway in California, slipped out early in 1941. It required several months and the expenditure of $64,000 to restore the fills in a way designed to prevent recurrence of the slip.

The two fills, 11 and 12 miles respectively north of Santa Cruz, in an earthquake fault area, had stood up under traffic for seven years; but several successive unusually wet seasons caused the ground water to rise so high as to cause hydrostatic head on and saturation of the soil under the embankment, lubricating it.

The slippage was along circular arcs from top down, with increasing taper, to the bottom. It continued for several days, extending out for over a half mile at the north slip, and extending as deep as 15 ft. below the original surface. Fortunately neither slip extended beyond the center line of the 4-lane highway, so that traffic, which ran about 4,000 on week days and nearly 16,000 on Sunday, while inconvenienced, was not stopped entirely.



Typical strapped connections of 2" horizontal drains to collection pipe, which later was covered with 5 ft. of crushed rock.

The reconstruction consisted of removing all loose material, providing drainage to keep ground water level well below the bottom of the embankment material, and rebuilding the embankment. Bulldozers removed the material just far enough to get it out of the way of the new embankment, leaving it there to serve as a buttress. Excavation was carried down into the soft top of the original foundation to solid material; shale or sandstone was reached at a depth of a few feet over much of the area, but at one part of the south slip it was necessary to excavate nearly 30 ft. depth of the original soil. Many 1-inch soil tube borings were made to determine beforehand how deep the stripping should be carried. About 20,000 cu. yd. was so removed in the south slipout and 12,000 cu. yd. in the north, over half being original ground.

As the upper portion of the foundation was stripped, a flow of water emerged estimated at 10,000 gpd; and as stripping progressed downward, new outlets opened and the upper ones dried up. To afford a permanent outlet for this water a system of drains was installed. The soil was so fine that these had to be placed rather close together and penetrate well back from the surface. In the north fill, 32 2" drains were installed, and 64 in the south fill. These were connected to 6" collectors, and these to a main drain which ran down the approximate middle of each slipout. The 2" drains were located at five main levels, with a few intermediate ones. In the lower portions of the fills, the pipes radiated from a working bench at the bottom of the trench. At higher levels, where the slipouts widened, they were so located, at somewhat uniform intervals around the faces of the slipouts, as to penetrate the entire steep foundation as uniformly as possible. If, after installing drains, seepage still occurred near

Last stages of 30,000 cu. yd. fill in restoring washout 11 miles north of Santa Cruz.

them, additional drains were installed. The drains varied in length from 17 ft. to 125 ft. in the north fill and from 17 ft. to 141 ft. in the south; the combined length of those in the north fill totaling 2,000 ft., and in the south fill 2,514 ft.

The drains were of 2″asphalt-dipped standard steel pipe, with perforations at 2¾ in. centers along the top and both sides. They were installed by means of a "hydrauger", a machine which the Division of Highways has used during the past two years for similar purposes. This, by means of an air motor, rotates a drilling rod carrying a 4″ or 5″ auger head, and also forces through the hollow drill rod and the auger head a stream of water which washes the loosened soil back through the hole. The drill is then removed and the pipe pushed into the hole. In general, the drains were made as long as possible, the length being limited by caving in of the hole before the pipe could be installed or because the hole could not be driven further. In the south fill 3,777 ft. of hole was drilled but only 2,514 ft. of pipe installed. The gross cost per foot of pipe actually installed was approximately $2.50 on the north slipout and $2.06 on the other.

The 6″ main drains were galvanized and asphalt-dipped, perforated metal pipe, with perforations on top, laid in the bottom of a bulldozer-width trench 10-ft. deep; which trench then was filled to a depth of 5 ft. with ¾-in. to 2½-in. crushed rock; 2,500 tons being used for this purpose in the north fill and 2,275 tons in the south. Several permanent wells were driven along the roadway at each fill, by which the ground water level can be determined at intervals and rise in it detected.

As soon as the drains had been completed, the rebuilding of the embankments was begun. For this was used siliceous material obtained from a borrow pit three miles away. This material was dumped over the side of the slipout, moved into position by a bulldozer and compacted with another which pulled a heavy sheepsfoot roller, resulting in an average relative compaction of over 95%. The fills were brought up in level 6″ lifts and the outside edges thoroughly compacted by regularly running the sheepsfoot roller over the slopes of the fills. As the fills progressed, the rock drains were carefully covered with fill material and the tractors were not driven over them until they had been covered with at least two feet of fill.

Particularly in the south fill, large portions of the original fill along the sides of the slipouts had been fractured and this loosened material was moved out and reconsolidated in 6-inch layers as the fills progressed. An estimated amount of 20,000 and 12,000 cubic yards, respectively, in the south and north fills was thus recompacted.

In the south fill, 740 tons of rock, averaging one ton in weight, were placed on the foundation at a level above the toe of the fill. This large rock increases the shearing resistance against sliding. As a further insurance against slippage, the new fills were increased in width by 40 feet for a height of approximately 50 feet. These buttresses or counterweights greatly increase the resistance against slides of the circular arc type. The total quantity of new fill was approximately 55,000 cubic yards, with 30,000 cubic yards going in the south slipout.

(Continued on page 27)

Installation of extensive drainage system under way. Insert shows outlets of 2″ perforated pipe drains.

Building Standardized Bridges for a County

By J. F. MOLLENKOPF
Engineer, Van Wert, Ohio

By making standard plans applicable to any small concrete bridge or culvert, the plan for a given culvert could be made in two hours by filling in the variable dimensions. Construction through a winter of zero weather is described.

VAN WERT County, Ohio, being situated near the watershed between the St. Lawrence and Mississippi rivers, has no large streams, but numerous small ones, so that its bridges (or culverts) are of short span. (Once, the resident engineer for the State wrote to the State Bridge Department, asking the difference or dividing line between bridges and culverts. He received the reply that it was the same as between a shoat and a hog. After the atmosphere cleared, we always called them bridges.)

On taking over the office of County Engineer in 1937, the writer decided to standardize these short-span bridges and a standard plan was drawn up from which blue prints were made in quantity. On this plan the fixed dimensions were shown, but the variable dimensions were indicated by blank spaces sufficiently large that the dimensions could be written in. Also blank spaces were left for writing in the angle between the wing wall and the face of the abutment extended. The reinforcing bars were indicated by letters for each class, and indicated the same way on the material sheet where the lengths and the weights were given. The title also was blank in part, so that it could readily be filled in. The variables naturally were span, width, height, wing direction and skew; knowing these, the blanks were readily filled in by referring to tables we had prepared. It took only a couple of hours to do this, as against a couple of days to prepare a separate plan for each bridge and trace it. The deputy or I would prepare the first plan in pencil on one of the blue prints and one of the rodmen would make as many copies in ink as were needed for our own crew and for the W.P.A.

General Plan

Foundation.—In this locality we have a very stiff clay subsoil, underlaid by blue limestone, the depth varying from two feet to forty or more. Occasionally we find sand, but in no large quantity. Three feet was generally shown on the plans as the depth of the foundation; but it was understood that this would be reduced should the bottom warrant, or be increased if, when reaching this specified depth, the conditions were not satisfactory. The crew soon learned what would pass, though I made it a practice to be on hand when the bottom was likely to be reached. The width of the bottom under both wings and abutment was set at 0.4 of the height of the abutment.

Abutments.—The top of the abutment or bridge seat was made 18″ wide, which allowed 15″ support for the "I" beams and 3″ beyond them to protect their ends and for a backwall. The front batter was set at 1:12; the back batter was approximately the same but, since we made it a rule not to show a fraction of an inch on the bottom dimension, this was not strictly adhered to. The face of the abutment was plain.

Wings.—The wings usually were set at an angle of 30° with the face of the abutment on the up-stream side. On the down-stream side no angle was used unless other conditions presented factors that had to be taken into consideration. The batter was the same as on the abutment. This gives a rather heavy wing section, but since we have a very decided frost action during the winter season and the amount of water present varies from time to time during the winter, we decided to build on the safe side.

The top of the wing was generally at the same level as the top of the bridge floor (though this could be varied if preferred) as the general public seem to prefer the wings to show at the ends, making it easier to see the bridge at night than where the wings are on a level with the berms. The extra cost is not great and the construction is much simpler.

Floor.—The width of the bridge is shown as a floor dimension in our plans. The minimum width is 20 ft. and this is increased as needed, usually in 3-foot increments for reasons of simplicity.

We use I-beams in the CB or WF type, as they give a much stronger beam for the same weight per foot. The joists are spaced 3 ft. on centers, except the outside space which is 2 ft. 10 ins. to provide better hold for the reinforcing bars of the railing. The list of I-beams used is as follows:

Span	*CBI or WFI*	*Wt. per Ft.*
16 ft.	12 x 6½	25 lb.
18 ft.	12 x 6½	28 lb.
20 ft.	14 x 6¾	30 lb.
22-24 ft.	14 x 6¾	33 lb.
26 ft.	14 x 6¾	37 lb.
28 ft.	16 x 6¾	37 lb.

These sizes are pretty heavy but they should last for 50 to 100 years. Also, we feel the extra cost is justified, since we have no way of knowing what they will be called on to carry as time goes on.

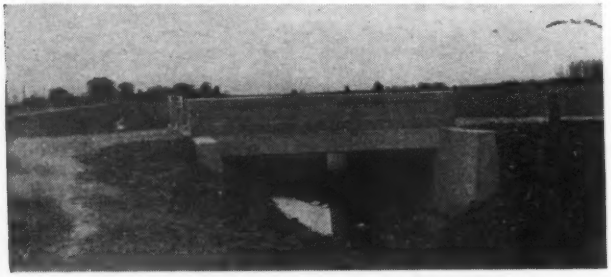
Reinforcing Bars.—All reinforcing steel is straight bars, classified in four sets of bars known as A, B, C, and D bars. The A bars are the transverse ⅝″ bars, placed directly on the joists, 6″ c-c, and held in place

by the B bars which run longitudinally, one between each set of joists, and are wired securely to the A bars. The B, C and D bars are ½". The concrete of the floor system is 7½" deep, the top of the concrete being 6" above the joists and extending 1½" below, which forms a clincher around the top and holds the "I's" firmly in place.

The total width of the bridge is 2 ft. 4 ins. plus the clear roadway, this providing the space for the railings.

Railings.—These are 12" in overall thickness. The panels are set in approximately 1½" and are formed by using two thicknesses of shiplap, the bottom thickness consisting of strips nailed to the panel and the second being the full size of the panel. The champfer is made by nailing 1½" triangular strips along the edge of the panels. These can readily be changed when the panel is used on another length bridge. The reinforcing is of C bars set in the floor, spaced 2 feet on centers and are of such a length that they set about one foot in the floor. To these are wired the D bars, which are spaced 12" apart.

Skew.—The abutments are set at right angles to the line of the highway whenever it is at all possible. However, there are times when this cannot be done, so our plans provide for showing an angle between the centerline of the stream and the center of the highway.



Up-stream side of bridge. Wings spread only about 10° from the faces.

Layout.—In laying out the bridge, we set stakes on the line of the abutments at the top and a line along each side of the bridge at the outside of the floor line. This puts the stakes as much as possible out of the way of construction work.

The writer does not claim to have originated the idea of a standard plan in blank form; he borrowed it from the engineer of an adjoining county. This method came in handy when preparing plans for the WPA as they required several copies for their files. The WPA crews took readily to building these bridges, since the plans were all similar and easy to understand.

Winter Construction by WPA

In the winter of 1939-40, finding that our supply of available WPA work was running low, we decided to build a number of these bridges in spite of the near-zero weather. Under our agreement with the WPA, the county supplied all the machinery and did the hauling and furnished an inspector who also acted as instructor; and in many cases machine operators were furnished. The WPA supplied the labor and cement on account of a large quantity of tiling included in this project.

The work commenced on Jan. 21, 1940. The thermometer stood near zero, and there was from 20 to 28 inches of frost in the ground, making the use of dynamite necessary to loosen it. The trenches for the foundations were opened quite wide on top and stepped down so that the steps formed working space for the men (all the excavation was done by hand) and made it possible to place the forms readily; also there was little trouble with cave-ins. The material was hauled away in wheelbarrows.

As all the bridges were nearly of the same height, we built panel forms that could readily be added to, so by making the first panel to fit the lowest height we could easily enlarge it to fit the higher ones. The wings being the same size as the abutment, it was easy to start at the ends of the wings and work to where the angle occurred, and then fill in the remaining space. The wings were carried up to their required height and blocked off at the bridge seat.

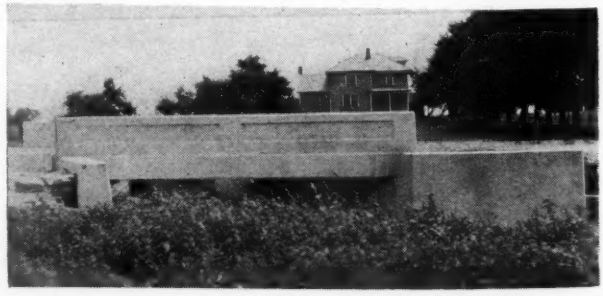
The floor forms were carried on the joists; 2x8" plank were set edgewise on the lower flanges and across their tops were fastened 2x4" cross pieces cut to fit loosely between the "I's" so that they could readily be knocked out when the concrete had set. On these cross pieces, shiplap lumber was placed, making a floor the right height if the "I" was 12". Where the "I's" were 14", the cross pieces were set edgewise, and where the "I's" were 16", two sets of cross pieces were used. Since lumber is not always full size, the concrete was at times a bit over in thickness.

The railings were all the same height, so we built panel forms sufficient for the longest span. The paneling was tacked lightly so that it could readily be changed without damaging it very much. The damaged lumber could be used in the bottoms for the floors, so little was lost that way. The end panels could be set anywhere to the required dimension.

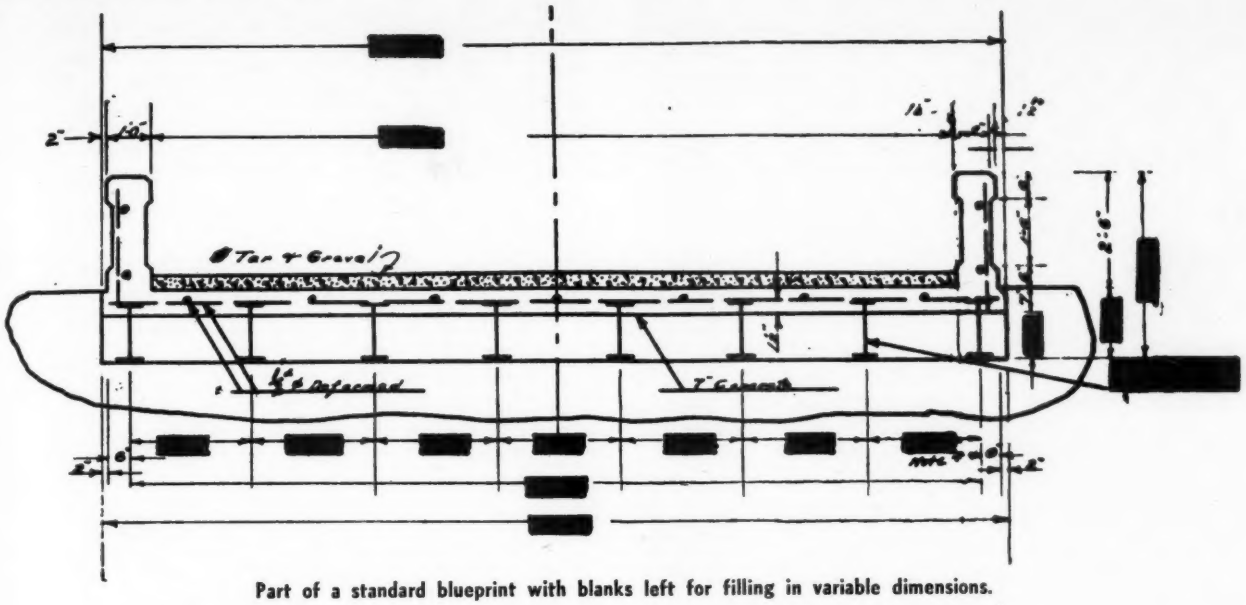
The county owns a one-bag mixer; since the jobs are usually small, this is sufficient for all the work to be done. On account of the freezing weather, all the aggregates had to be heated, the stone and sand being placed in piles over used culvert pipes. Just before a run was to be made, fire was started in the pipes; since we did not bring the material on the ground until we were ready to use it, very little firing was needed.

The water had to be hauled during the freezing weather, so we cleaned out the 800-gallon bituminous distributor belonging to the county, which was equipped with pump and heater. On the afternoon before a run was to be made, the distributor was filled and partly heated so that, starting a fire in the morning, by the time the distributor was on the ground it was ready to supply water heated up to 175° F.

Calcium chloride was used up to 1 to 1½ lbs. per bag of cement. We dissolved the chloride in water. using a pound per gallon of water; thus a small bucketful made the correct amount for each batch. By starting early in the day we would finish a run



Bridge on 30° skew with highway. Left wing is straight with abutment; right wing angles 60° making it parallel with roadway.



Part of a standard blueprint with blanks left for filling in variable dimensions.

in plenty of time for the concrete to start to set before it began to get very cold; and as heat would be generated by chemical action by that time, very little heating was necessary to keep the concrete from freezing. The railings were not poured until spring, since it is difficult to protect them in winter. We did not lose any concrete by freezing, though we began running concrete on February 1st and kept on until summer. In all, 15 bridges were built that year. The WPA superintendent, an old contractor, kept his eyes open for weather signs and government reports so that he could run the concrete just as a storm was passing or had passed and almost always had a couple of good days for the concrete to set and get off the forms before another storm came. Whether it was good management or just good luck, the credit was his.

The forms were removed as soon as they would let go and were then oiled and such repairs or changes made as were necessary to fit them for the next job. Rubbing started as soon as the forms were removed, using carborundum or a block made of cement and sharp, coarse sand. To give a uniform color to the work, we made a wash the consistency of thin cream, using Keene cement (white). This was applied with a whitewash brush and immediately rubbed. Before the wash was applied, we removed any projections caused by cracks or other openings in the forms. (An old axe is a very good tool to remove these projections.) Any rough places were dressed and the holes, if any, patched, using cement of the same proportions as was used to run at first. A surfacing tool, as used by plasterers, made of a small board with a handle attached, comes in very handy in the rubbing.

Rubbing over these repairs, using the wash for wetting, gives a very uniform appearance. While running the cement, however, care was taken to have men tamping or spading the concrete at all times and watching the dumping to see that the forms were uniformly filled and kept level. We used rubber-tired wheelbarrows to handle the concrete from the mixer to the forms. The use of troughs, etc., for this was found to be less satisfactory on account of the separation of the materials, causing honeycomb. Much of this is elementary; however some contractors do not seem to be familiar with many of the simple ways of getting good results with very little, if any, additional labor.

The back-filling was left until just before the bridge was to be opened to traffic, except that the stream was cleaned out just before the floor forms were set and all excavated material was thrown over the abutment walls and became back fill, thus lessening the amount of handling necessary if it had been removed at the time of excavating for the abutments. We removed all material to a level with the bottom of the stream, which provided much more flood capacity than the previous practice of sloping up the sides of the channel uniform with that above and below the bridge.

Uniformity in results was secured by keeping the same man in charge of each of the different jobs, as trench digging, form buildings, rubbing, etc. A single foreman could keep work moving on two or more bridge sites simultaneously without loss of time. The inspector supplied by the county was on the job at all times and acted as an instructor to show how the work was to be done rather than as a fault finder after the work was in place. This required some tact on his part.

On the whole, the work was very satisfactory, especially since it was carried on at a time of year when there are many difficulties to be overcome. None of the structures shows any sign of frost damage and the indications are that they will last for many years to come.

Draining to Prevent Slippage of a Road Fill

(Continued from page 24)

The 6″ perforated pipe, of which 750 ft. was installed in each slipout, cost approximately 40 cts. a foot. The total cost of all drainage features in both fills was $18,650, of which $10,200 was for 2″ drains. The total cost of all work was $64,000, of which $36,000 was for work on the south fill. All work was done by the forces of the Division of Highways.

The above is condensed from an article by George F. Hellesoe, district maintenance engineer of the Division in "California Highways and Public Works" (official Journal of the Division of Highways); to which we are indebted for the illustrations of the article.

Treating a Bad Case of Ceratium at Hillsboro, Ill.

By FRED A. ROEMELIN
Superintendent of Waterworks

THE source of supply for the City of Hillsboro, Illinois, is an impounded reservoir and we encounter the usual taste and odor problems expected from a surface supply. Occasionally, we get something different that is very difficult to control.

On May 28, 1941, we noticed that the lengths of our filter runs were reducing very fast. Upon examination, we found the top of the filter beds to be very hard; when you stepped on the sand or struck it with anything, it was like striking or stepping on a board rather than sand. As we inspect our filters at regular intervals, and they have been almost perfect from that standpoint, we began to wonder just what the trouble could be.

On May 29th, we collected a sample of the raw water from the plant intake and took it to Springfield for a microscopic examination. To give an idea of the ceratium concentration, I quote from an analysis by the State Department of Health: "The microscopic examination showed the presence of 400 ceratium per ml. (6000 sq. standard units). This sample also contained green algae, hormidium being present in amounts of 80 sq. standard units per one ml."

Ceratium is a protozoan which has been reported as being responsible for disagreeable or fishy odors in water supplies, and I will say that we vouch for this report, for our raw water had a very disagreeable fishy odor and when we washed our settling basins the odor was terrific.

As this was the first time this trouble had occurred at Hillsboro and also the first instance the Public Health Department has observed in Illinois of short filter runs caused by this organism, we were at a loss as to how to control it.

Our first step was to treat the lake with copper sulphate. Our usual dose of sulphate for algae control had no effect on the ceratium, so we increased the dose to five pounds of sulphate per million gallons with satisfactory results. Our lake capacity is 600,000,000 gallons and the raw water is brought into the plant (a long distance) by gravity through a 14-inch main, so it took a while to notice the results from the lake treatment. While we were waiting, the filter runs kept decreasing until we could only get one-hour runs. The lake water had no turbidity at the time, so we had to make a floc with chemicals. As we pre- and post-chlorinate all the time, we just increased our chemicals and the final dose was 5 ppm. residual chlorine in the raw water, with a residual of 0.35 to 0.5 in the finished water.

We also used five grains of alum per gallon, five grains of lime per gallon and five grains of activated carbon per gallon and we got splendid results. We also used copper-sulphate in the mixing chamber at the rate of five to eight pounds per million gallons while we were waiting for results from the lake treatment.

Some may disagree with me as to the amount of chemicals used, but I just have this to say, we whipped the odor 100% without even one complaint from the consumers; in fact, there was not a person in town who knew about our trouble except we operators and Commissioner Alton E. Woodruff whom we work under.

My reason for making this report is to show that the *odor caused by ceratium can be controlled by the application of activated carbon with proper pre-chlorination.* The splendid help given by our activated carbon agency is not to be overlooked, for these folks were ready and on the job as soon as they heard of our problem. We managed to whip the trouble before they were called but I certainly appreciated the exhaustive tests their representative made in checking for tastes and odors in the distribution system. We have used a good grade of activated carbon since 1930 and would not attempt to run a plant without it.

The above was written by Superintendent Roemelin for "Over the Spillway," issued by the Illinois Department of Public Health, C. W. Klassen, Chief Sanitary Engineer.

Limiting Grades for Driveways

By C. N. STUTZ
Ass't Engr. to J. J. Woltman, Bloomington, Ill.

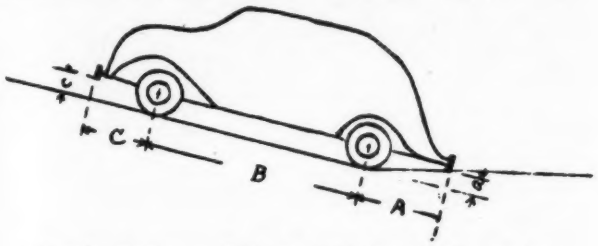
WHEN constructing new curbs and gutters or pavements, or widening existing pavements in built-up sections of a city, it is often necessary to increase the grades of driveways leading from the gutter to the sidewalk. The question then arises as to what is the maximum grade for a drive to prevent bumper guards of cars from dragging.

Measurements between bumper guards and wheels and the height of bumper guards above the ground were taken on a number of different makes of cars. These measurements are shown in the following table:

Car	*(a)*	*A*	*a/A*	*B*	*C*	*(c)*	*c/C*
Plymouth	15″	42″	36%	9′	28″	12″	43%
Buick	17″	48″	35%	10′	38″	12″	32%
Buick	15″	48″	31%	10′	36″	12″	33%
Ford	12″	46″	26%	9′	28″	14″	50%
Chevrolet	16″	46″	35%	9′	28″	12″	43%
Pontiac	12″	48″	25%	10′	28″	11″	39%
Ford	14″	48″	29%	9′	30″	12″	40%
Studebaker	12″	48″	25%	9′	30″	13″	43%
Oldsmobile	13″	48″	27%	10′	30″	12″	40%

Referring to the sketch, page 28, it is seen that the a/A or c/C is the maximum grade with reference to the adjacent street profile that a driveway can be built to avoid dragging. For the cars measured, the maximum grade is 25%. From this grade it is necessary to deduct the slope of the crown of the adjacent street.

For a 32′ street with a 6″ parabolic crown the slope from the gutter to a point 4′ out would be approximately 6%. This would leave (25%—6%) 19% as the maximum grade. If an allowance is made for the car being loaded and for possible change in car design, the maximum slope would probably be about 15%.



Sketch showing method of calculating limiting grades.

Patching Bituminous Surfaces

(Continued from page 17)

New Jersey.—Data sent in by 15 cities; 11 roll patches; 1 uses a portable roller. F. E. Harley, borough engineer of Fair Lawn, says, in regard to patches: "If penetration macadam is to be patched, remove old material, square up the hole, put in fresh stone, penetrate with oil from the distributor truck at the proper temperature and finish patch with same material as in original surface. David D. Cascino, city engineer of Garfield, removes all loose material and squares edges; then he pours in gasoline and ignites; applies ready-mix; dusts and rolls. Most of the cities indicate excellent practice.

New York.—Replies with details were received from 19 cities. Brooklyn, Arthur J. Griffen chief engineer, cuts out the defective area, trims the edge, thoroughly cleans the opening, paints the edges with asphaltic cement, puts in the appropriate mixes, smooths around the edge with a hot smoothing iron, rolls and dusts with cement or mineral dust. In Fulton, N. Y., Harry S. Andrews, city engineer, uses a 1-inch cover of Colprovia and after rolling seals the edges with a hot iron. With one or two exceptions, all the cities reporting follow sound practice.

Ohio.—Reports are at hand from 16 cities. Arthur Smalley, city engineer of Hamilton, cuts away the old material entirely, to the concrete bases in most cases, and places a new binder course and sheet asphalt wearing surface; the sides of the cut are usually painted with hot asphalt. In Middletown, L. P. Diefenbach city engineer, the steps are: Cut out patch, cut vertical sides, tamp and fill subgrade, paint edges with cutback, place premix, tamp and roll. C. S. Fullerton, city manager, Painesville, follows about the same practice.

Pennsylvania.—Information was furnished by 28 cities; 24 roll patches; 4 do not roll; no more than 4 use portable rollers. Oliver L. King, township engineer of Abington, cuts out the surface for 6 or 8 ins. beyond the damaged area, then uses standard materials and methods. Ashland, H. L. Burmeister borough manager, pays particular attention to the condition of the subgrade and repairs for it. C. H. Wentzell, city engineer of Greensburg, uses pre-mixed material in summer, but in wet or other seasons patches with an inverted asphalt emulsion surface mixed on the job. Practice reported in practically every city was excellent.

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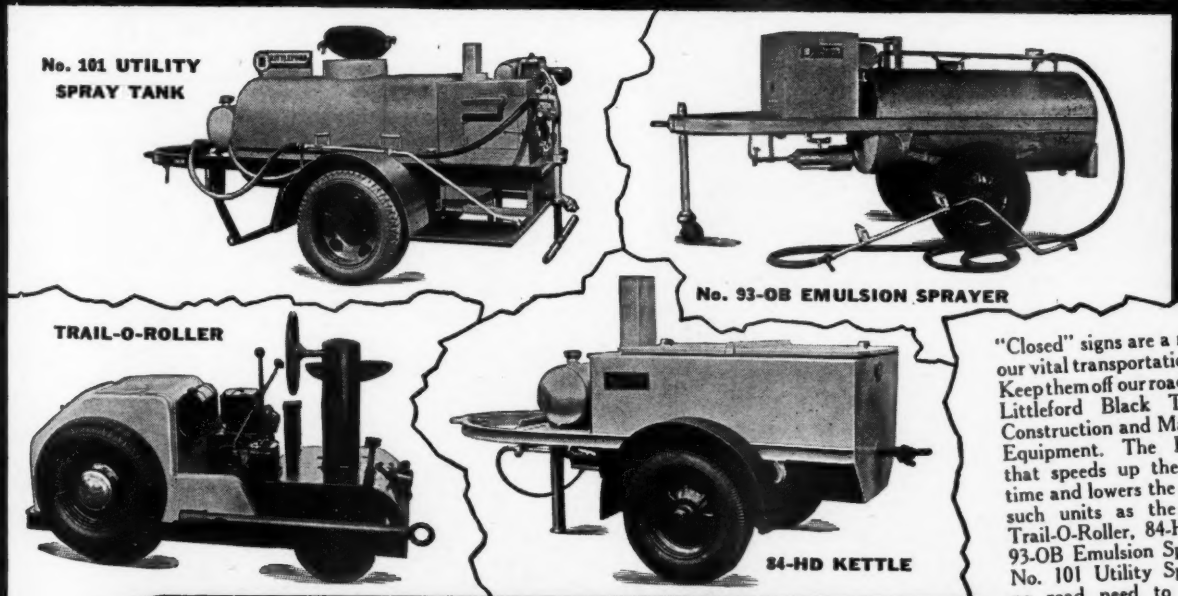

"Closed" signs are a menace to our vital transportation system. Keep them off our roads by using Littleford Black Top Road Construction and Maintenance Equipment. The Equipment that speeds up the operating time and lowers the cost. With such units as the Littleford Trail-O-Roller, 84-HD Kettle, 93-OB Emulsion Sprayer, and No. 101 Utility Spray Tank, no road need to be closed.

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Texas.—Dick G. Pepin, city engineer of Pampa, replaces the base area if it has failed, places a tack coat and patches. Charles Chappell, city engineer of Pittsburg, removes all damaged material, cleans base thoroughly, lets it dry if wet, primes, applies material and rolls. N. E. Trostle, city engineer and water supt. of Temple, says "If the base is too light, it is reworked and a new course of rock asphalt applied; if the failure is not due to the base, holes are patched to bring the surface to grade and the surface is then covered with a course of hot-top."

Virginia.—B. R. Fuller, town manager of Altavista, states "The hole is dug out with straight sides to a good, firm foundation, swept clean of dust, primed, filled with pre-mixed asphalt patch material, tamped and rolled and sanded."

Wisconsin.—J. W. Day, city engineer of Ashland, treats holes due to frost boils by digging out and building up. S. R. Craig, city engineer of Chippewa Falls, cleans out the hole, squares up the edges, tamps in coarse aggregates, pours or sprays on a seal coat and covers with sand and rolls.

Wyoming.—Rawlins, E. F. Sullivan city engineer, has been using rock asphalt for patching holes where the streets are in fair condition.

Ed. Note.—It is regretted that space limits and the undesirability of repetition prevents us from using but a few of the 500 or more valuable and to-the-point comments. Names, titles and addresses have been given to encourage engineers to correspond directly with each other for additional specific and detailed information. We believe that a mention of this magazine is sufficient introduction. Articles or letters detailing methods that are improvements over those given here will be welcomed by the editor.

Regional Organization of Federal Works Agency

Completion of this organization was announced June 25th as follows: For Region 1—John M. Gallagher, New York City, with Sub-Regional Office at Boston, Mass., Jas. A. McConnell, Asst. Regional Director. For Region 2—Kenneth Markwell, Richmond, Va. Region 3—R. L. MacDougall, Atlanta, Ga. District 4—Geo. H. Field, Chicago, Ill. District 5—Jas. W. Bradner, Jr., Fort Worth, Tex. District 6—Linus C. Glotzbach, St. Paul, Minn. District 7—Rex Lee Nicholson, Salt Lake City, Utah, and Sub-Regional offices at Seattle, Wash., R. L. Durkee, Asst. Regional Director, and at San Francisco, Calif., Pierce Williams, Asst. Regional Director.

Surface Loads for Flight Strips

On page 7 of our June issue, under the head "Flight Strips to Be Built," the statement was made that "the heaviest wheel loads on the runways will probably be . . . 583 lbs. per sq. in." This and the other figures in this paragraph were taken from a statement made by a Lt. Colonel of the Army Air Forces at the April meeting of the Association of State Highway Officials of the North Atlantic States, who has since made the following correction: "My statement concerning surface loads for flight strips . . . was clearly erroneous. I regret that this mistake, which was committed in the preparation of my paper, was unnoticed by me. . . . Using a correction factor of 0.9 to compensate for tire rigidity, the net contact area would be approximately 771 sq. in. Sixty thousand pounds divided by 771 sq. in. equals 78 lbs. per sq. in. uniformly distributed unit load. Employing the arbitrary factor for impact of plus 25 per cent increases this unit value to 97.5 lbs. per sq. in. For convenience 100 lb. per sq. in. may be used."

The completion of the first flight strip on the Atlantic seaboard was announced June 29.

Exchange Old Parts for New

When purchasing replacement parts made of any of the critical materials, send the old part to the manufacturer with the order, if possible—it is the quickest way he can get the material for manufacturing the new part. This is required in the case of aluminum. The copper deficit this year is placed at 975,000 tons.

Renewals of Sewage Sprinkler Arms

By C. L. GREGSON

Surveyor, Withnell Urban District Council, Lancs., England

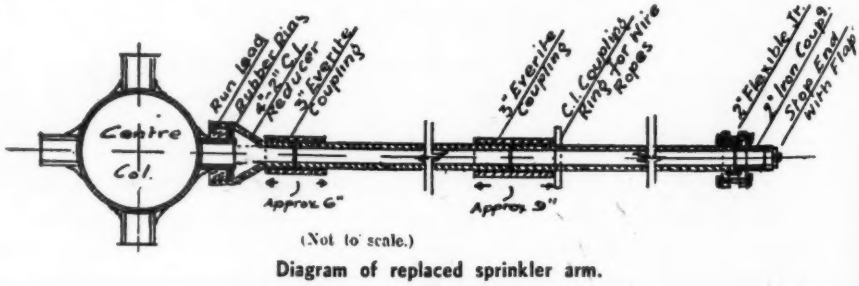
I HAVE no doubt that many surveyors have been concerned over the problem of renewals of sprinkler arms at sewage works, and for the benefit of those who have this problem before them at the present time I am sending you the results of an experiment which I have recently carried out at my council's works:—

As iron and steel were very difficult to obtain, I decided to make a test with "Everite" piping, and ordered sufficient lengths for two four-arm sprinklers of 40-ft. diameter. The piping is in lengths of approximately 10 ft. of 2-in. internal diameter. (The pipes can, of course, be cut to any length.) I arranged with the firm to bore ⅜-in. holes in the pipes, reducing from the centre column in the usual manner. I also ordered and tested the flexible couplings for the main joints, but found this unsuccessful. The difficulty was solved by using short lengths of 3-in. Everite piping as couplings for the joints. At the end of the arm I used a flexible joint with a 2-in. iron coupling into which was screwed a short length of iron pipe to hold the gunmetal stopped end with the hinged flaps for cleaning purposes.

To couple the arm to the centre column I used a 4-in.-2-in. cast-iron reducer with a rubber ring and run lead joint.

The sprinkler arms were then staved with flexible wire in the usual manner. The sprinklers are now working perfectly satisfactorily.

The attached rough diagram shows the fixture in detail.—*From "The Surveyor" for December 21st.*



(Not to scale.)

Diagram of replaced sprinkler arm.

Measuring Unevennesses of Road Surfaces

For measuring unevennesses of road surfaces, investigators in Sweden have used a new apparatus which measures and registers unevennesses of six degrees of depth, and permits determination of the number of each class in a given length. The apparatus used consists of a 16.4 ft. long sledge, resting on two runners at a distance of 7.87 in. from each other. The runners, which must be straight and lie in the same plane, are adjustable by means of screws. A registering mechanism is built in the middle of the apparatus under which a drag is attached by an arm movable in the vertical direction. The drag, which follows the unevennesses of the road, has a contact surface in the form of an arc of a circle of the same radius as a motor-car wheel. The vertical movements of the drag are transmitted to the registering mechanism.

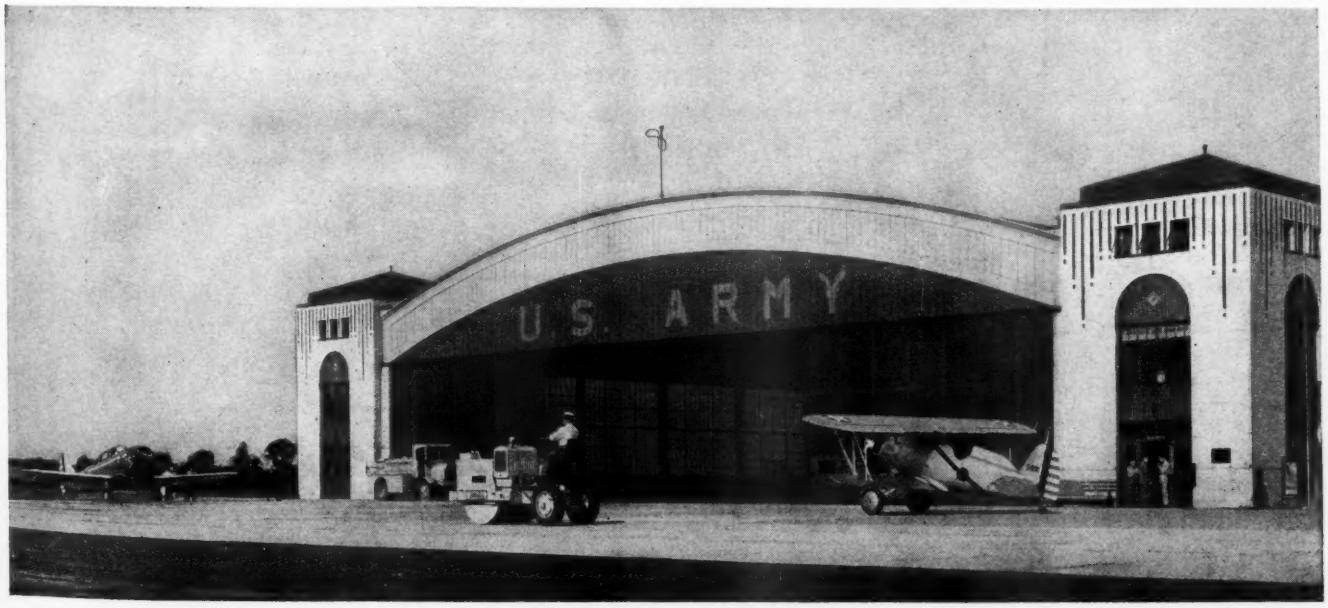
The registering mechanism has six separate counting devices (counters), which count the number of unevennesses, sort them, and sum them according to size. The counters indicate the number of unevennesses that are greater than 0.096, 0.191, 0.286, 0.382, 0.478 and 0.573 in. respectively, one dimension for each counter. The largest unevenness on a certain stretch can also be read on a scale, on which can also be read the value of the unevenness when the apparatus is at rest.

Further, the registering mechanism is provided with a planimeter which, as the apparatus travels, automatically measures the superficial content of the unevennesses, i.e., the surface between the road profile and a zero-line. With the aid of this planimeter it is possible to obtain a numerical expression for the unevenness of a certain stretch of road.

The measurements of unevennesses have as a rule been carried out along several parallel lines, and the counters have been read for every hundred meters (328.1 ft.).

From the planimeter value is obtained a single figure for the unevenness of a certain stretch of road, but no indication is given of whether there is a small number of larger unevennesses or a larger number of smaller ones. If this information is desired, the unevennesses must be sorted according to size, which is effected from the frequency curve.

With the object of forming an idea as to what claims can be set up in the matter of evenness, a statistical treatment of the measurement results has been carried out for some types of surfacings in rural districts. Thus the percental distribution has been calculated for the 0.191 in. unevennesses, for the 0.382 in. unevennesses, and for the maximal unevennesses, the values for all the 328.1 ft. stretches being added together. If the vertical axis is arbitrarily divided into three parts, it is possible to obtain a classification of the surfacings into "excellent," "good" and "less good." With the guidance of these diagrams and a further working-up of the investigative material, the following tentative claims have been set up concerning the evenness of different types of surfacings (all for a rule of 16.4 ft. in length):



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Full support to the war effort was pledged by Galion at the very start of war . . . we apologize to our customers for not being able to give 100% attention to their needs. Galion rollers and motor patrols are speeding up all kinds of war construction . . . are working extra shifts in order to hasten Victory. A Galion portable roller is shown above working on airport construction.

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TOPEKA	
Greatest unevenness	0.382 in.
Number of unevennesses greater than 0.191 in. on a length of 328.1 ft.	12
CONCRETE	
Greatest unevenness	0.236 in.
Number of unevennesses greater than 0.191 in. on a length of 328.1 ft.	5
SETTS	
Greatest unevenness	0.472 in.
Number of unevennesses greater than 0.286 in. on a length of 328.1 ft.	10

These claims comprise, firstly, requirements in respect of the greatest unevenness, and secondly, requirements in respect of the number of unevennesses on a certain length of road, which would seem to afford a rational principle for appraising the evenness of a road surfacing. The illustration shows these values graphically.

The above is an abstract of a paper by N. Von Matern and G. Kullberg in Bulletin 62, Swedish State Road Institute, published in Highway Research Abstracts, November, 1941.

Reconstruction of Bridge by German Forces

A steel bridge over a tidal river in France was destroyed and approaches mined by the French to delay the German advance in 1940. A nailed timber structure was constructed by German combat engineers to obviate a detour of 10 miles. Two days were occupied in clearing the approaches, removing a steel and concrete barrier, preparing working drawings and removing debris from the channel and constructing a temporary suspension footbridge. During this period the necessary timber was obtained from the main construction battalion stationed 40 miles away, as no wood was obtainable locally. All timber used had been treated with preservative. The new bridge, which was constructed for 16-ton loading, consisted of seven Warren trusses 50 ft. long, each weighing 3½ tons. These were carried from the assembly yard to about 100 ft. from the site and placed on rollers, on which they were moved into position, being held vertical by a block and tackle at each end of the bridge. The timber deck, which rested on transverse beams, was covered by a double plank surfacing, the lower planks (3.2-in.) being placed transversely, while the wearing course (2-in.) was placed longitudinally. The guard rails and two narrow raised footways were completed after a loading test had been applied by driving two heavy lorries on to the bridge. The structure was finished and opened to traffic in six days.

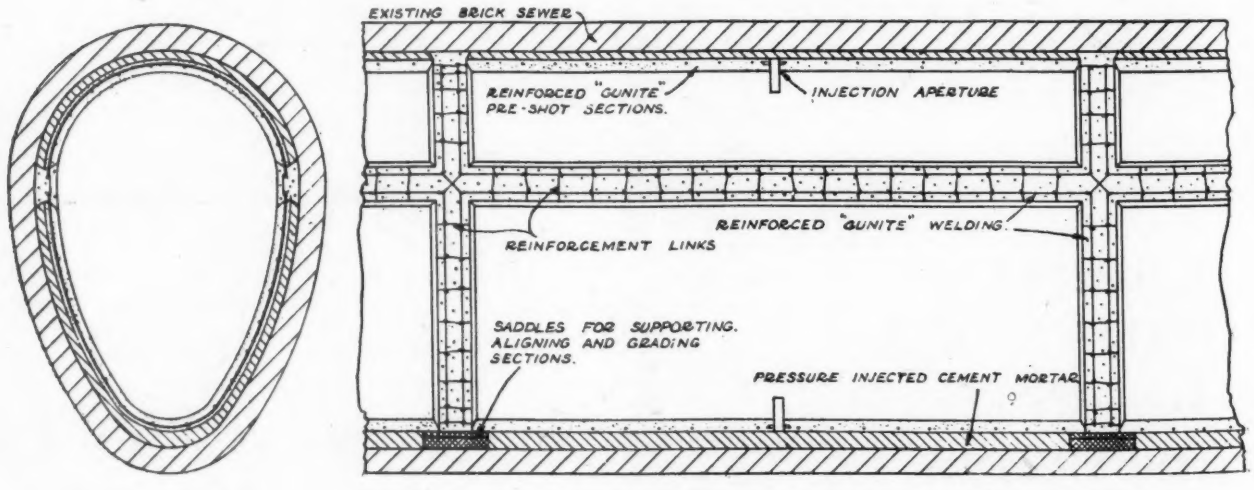
Lining Sewer With Preformed Gunite

Trunk sewers of Reigate, England, built in 1865-1875 were found to be cracked and distorted over considerable lengths, and repairs have been made recently. The sewers were of brick, egg-shaped and varying in size from 3′ 6″ x 2′ 4″ to 4′ x 2′ 8″, mostly 9″ thick but in parts 4½″ of brick surrounded with concrete.

First repairs were made by guniting on reinforcement, the lining being made 2″ thick in the invert and to a level 18″ above, and 1¾″ thick above that. Six years later, when more repairing was imperative, all this lining was found to be in excellent condition; but because of the small size of the sewer the cost was high, and another method was tried out on a 120 ft. length and then a contract using this method was let for 7,400 lin. ft. This method is described as follows by "The Surveyor":

Moulds, built in timber and faced with steel sheeting, to ensure a perfectly smooth inner surface, one to conform to the profile of the invert and sides of the existing sewer, and one to conform to the crown, are prepared; they are 4 ft. in length, hinged in the centre, and fitted with turnbuckles to permit of variations in width and profile rendered necessary by the deformities in the sewer itself. On the moulds, the electrically-welded reinforcement fabric, consisting of 3/16 in. diameter rods, spaced at 4-in. centres each way, is fitted. The "Gunite," consisting of 3 parts of properly graded sand and 1 part of Ciment Fondu, is then "shot" against the steel surface of the mould with the "Cement Gun" and built up to a thickness of 1½ inch.

The pre-shot sections are lowered, after maturing, through working openings made in the sewer onto a specially designed bogie, on which they are conveyed along the sewer to their required positions. The crown section, which is supported in position by iron spikes driven into the old brickwork, is first placed, followed by the invert section, the latter being suitably supported to conform to the new grade line. The reinforce-



Cross-section and longitudinal section of sewer, showing method of lining.

ment in the pre-shot sections protrudes 2 in. from each end; the fabric is joined, so becoming continuous throughout the entire length, with wire links of similar gauge, and the spaces between the sections are closed with shot *in situ* "Gunite," thus effectively welding the sections together. The longitudinal joints, or welds, between the crown and invert sections are similarly dealt with.

The annular spaces between the outer faces of the pre-shot sections and the inner wall faces of the old sewer are filled with portland cement mortar, under pressure, holes being provided in the sections to permit the introduction of the injection nozzle. This injected mortar finds its way, not only into these annular spaces, but into any cracks and open joints in the old brickwork and renders the new lining homogeneous, and monolithic with the original structure.

Where tributary sewers and house-connections join the trunk sewer, suitable openings in the pre-shot sections are provided (during the pre-shooting process) to accommodate them.

This method "proved eminently satisfactory in every way." Because of the smooth surface and even gradient, the capacity of the lined sewer was equal to, if not materially greater than, that of the old.

Waterworks Maintenance in Reading, Mass.

Reading, Mass., experienced three breaks in their water mains during the year 1941, two of which were due to blown joints, and one an actual break in a 12" supply main. On Tuesday, September 30, at 9:50 P. M., a break was reported in the 12" supply main on Main Street between Franklin and Mill Street. The 12" gate at Main and Franklin Streets was closed at 10:40 P. M., leaving the entire section north of Franklin Street without water. Excavation started immediately to repair the break, and work continued until early evening on Wednesday. The break was found to be a four-foot split in the bottom of a length of pipe. Cause of the break was apparently due to the close proximity to the pipe of a large boulder, which, with continual vibration of the roadway from passing heavy trucks, caused the pipe to split. The split section of pipe was removed and a short length of pipe and a solid repair sleeve installed in its place. Water service was resumed at 2:30 P. M. Wednesday. Approximately four feet of water was lost from the standpipes by the break.

Late in the fall, a systematic investigation was begun of all main gate valve boxes. Measured tie distances are on record of all valve boxes but, as these ties were taken from semi-permanent landmarks such as trees, poles, buildings, etc., some of them many years ago, and many of which have from time to time been removed, it has become necessary to relocate many of the boxes. As each box is relocated, an inspection is made of the condition and accessibility of the gate valve itself, and any repairs or changes necessary are made. In several instances, boxes have been either raised or lowered to grade, broken boxes replaced, and dirt-filled boxes cleaned out.

An increasing number of complaints of poor pressure in house services have been received, caused mainly by the accumulation of sediment in the older galvanized service pipes. A method of improving pressure in these services has been devised, whereby, with a flexible wire cable, the service pipe is rodded and cleaned out from house cellars to supply mains. A number of services were so treated during the year.

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Sanitation at Contractors' Plants on Delaware Aqueduct

BUILDING shafts for the Delaware aqueduct required surface construction operations at 25 points, 11 of them located within watersheds of New York's present supply. As most of the workmen come in automobiles there are no contractors' camps at any of the construction sites, but there is considerable weak sewage created by shower baths and boot-washing sprays in addition to lavatories, urinals and closets. The sewage drains to existing public sewers in five construction areas and to treatment plants in the other twenty. These plants consist of septic tanks and intermittent sand filters and effluent chlorinators in 18 cases, and with septic tanks in the other two.

The sewage is weak and contains little grease. The weekly average amount at 13 of the areas during 18 weeks varied from 8 to 54 per man, the general average being 25 gpd. A description of a typical plant was given by Frank A. Marston in a paper before the New England Water Works Ass'n. in which he described the sanitation features at these areas; and an abstract is given below of his description of a typical sewage treatment plant. Of the 20 plants, 17 have septic tanks of 5,000 gal. water capacity (24 hr. flow), the others are larger. Each tank has a bottom sloping steeply from inlet to outlet end, and is divided by a central transverse wall, the sewage flowing over a weir from the first compartment to the lower one, and from this over a weir into a collecting chamber. There is a baffle in front of each inlet and a scum board at each outlet. A sludge pipe is located at the lower end of each half of the tank. The tank effluent passes through collection and distribution manholes to a two-compartment dosing tank equipped with siphons designed to operate alternately placing a 3" depth of sewage on the filter beds.

There are, for each of the 17 smaller plants, four filter beds of 510 sq. ft. each, having 3 ft. of sand on graded crushed stone surrounding tile underdrains. Filter effluents are chlorinated, and the permits for the plants issued by the State Dept. of Health require that the plant effluent have a residual chlorine content of at least 0.5 ppm. The sludge beds consist of 6" of sand of an area equivalent to 1.3 sq. ft. or more per capita.

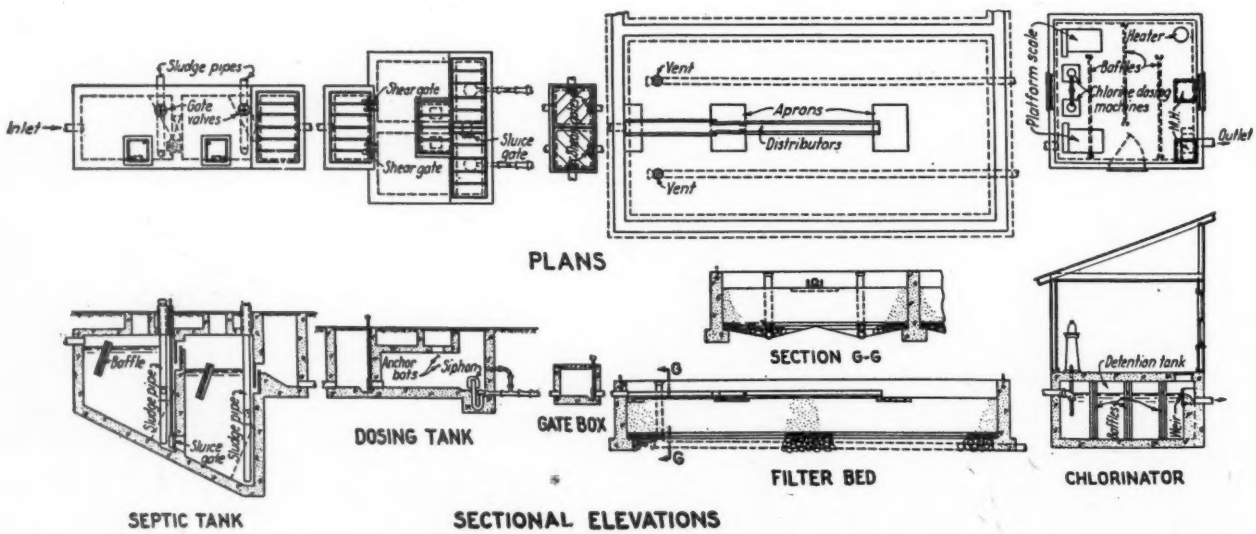
The filter beds were designed for 100,000 gpad, or 2.3 gpd per sq. ft. of surface; equivalent to 4,000 persons per acre on the basis of 25 gpd per capita. At one plant for the period April 1-June 30, the filters operated at an average rate of 5.2 gpd per sq. ft. and population load of 4,700 per acre, reaching 7.7 gpd during June. Following this, the sand became clogged and had to be renewed, after two years' operation, during which they had been scraped 3 times, removing 3" to 4" of sand each time. The effluent from the plant continued excellent throughout.

Proposed Ground Water Supplementary Supply for Rochester

Rochester, N. Y., is considering the possibility of supplementing its present surface supply of water by developing an underground supply which is known to exist near the city. In 1934 information was collected concerning the depth of bed rock throughout the county. A contour map of the rock, plotted from these data, showed that in preglacial times the Genesee river had run east and west in the southern part of the county, then turned north into Lake Ontario. (The existence of such a preglacial valley had, 20 years before, been prefigured by Dr. Herman L. Fairchild, Professor Emeritus of Geology of the University of Rochester.)

In 1940 the city made an agreement with the United States Geological Survey, Geophysical Exploration Division, to locate this preglacial valley at a point near Rush reservoir, which was done by the seismic method during the latter part of the year. This survey showed the valley to be nearly a mile north of the location indicated by the 1934 investigation, demonstrating the value of a seismic survey. This valley appears to be about a mile wide, covered to a maximum depth of not more than 500 ft. with sand, gravel and silt deposited by glaciers.

In order to determine the quantity and quality of water obtainable from the preglacial valley at this point, late in August, 1941, a contract was let for



Typical sewage treatment plant at contractor's plant.

drilling, casing and test pumping test holes at this point, and drilling the first hole started Sept. 22, but had not been completed when, in November, this information was furnished to the Rochester Engineering Society by Herbert A. Zollweg. The hydraulic rotary method was used in drilling, a mixture of clay and water being pumped through the string of tools into and through the bit and rising to the surface outside the tools, bringing up the drillings with it and "mudding up" the wall of the hole so that it will not cave in and no casing is necessary until the drilling has been completed.

Utilizing Elevated Storage for Increasing Supply and Economy

Many municipal water systems have installed sufficient elevated storage capacity to take care of future growth. Others have based their elevated tank capacity on the weekly cycle needs of hot summer months. Both procedures give them capacities in excess of normal daily needs, particularly during the winter months. This surplus capacity may be used to release generating capacity to industrial plants during the work day by pumping a greater proportion of all the water used at times when the industrial plants are not operating. Two general examples are as follows:

EXAMPLE A

Elevated storage capacity	1,000,000 gals.
Fire flow requirements	250,000 gals.
Capacity available for general service	750,000 gals.
Average daily requirements	600,000 gals.

Under these conditions, all pumping could be done at night or other off peak time. The water department would have to watch its operation closely and cut in pumps for short periods at the least disadvantageous time—probably at noon—to supplement the reserve on days of high demand.

EXAMPLE B

Elevated storage capacity	2,000,000 gals.
Fire flow requirements	500,000 gals.
Capacity available for general service	1,500,000 gals.
Average daily requirements	2,225,000 gals.

In this case, the water department could pump 1,500,000 gals. (filling the tanks) at night. The remaining 750,000 gals. would have to be pumped during the day when power demands are lowest.

There is no master plan that will produce maximum benefits from storage in all water systems. Each operator will have to analyze his own conditions and set up the operating method that will give him the best results. In some cases no material improvement may be possible.

Any plan of this type will require careful supervision. Cooperation between the water department, power company, and possibly some of the large power users, will be necessary.

Before instigating any changes, however, operators should consult with the National Board of Fire Underwriters or their local inspection bureau.

(From "The Water Tower")

Dothan, Ala., owns and operates the city's electric distribution system, purchasing the power supply wholesale on a demand charge basis. Previous to 1939 the only water storage was a $150,000 gal. standpipe and a 1,000,000 gal. ground-level reservoir. During the three months of the year when the local cotton gin and oil mill were operating, the city paid a high penalty for power due to the demand charge. In 1939 a 750,000 gal. elevated tank was built. Now most of the

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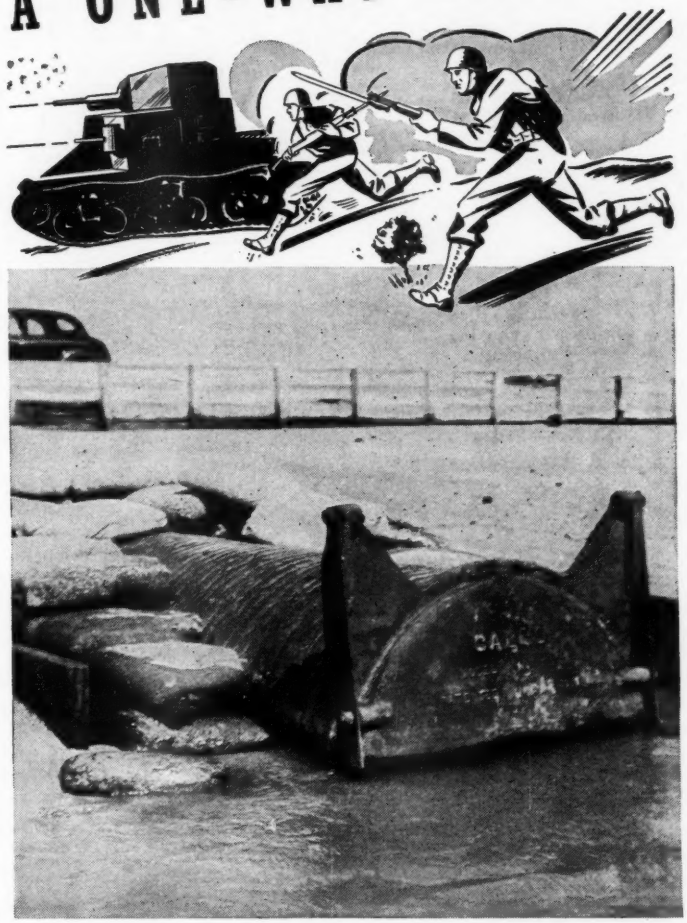

Calco-Hardesty Gates have "gone to war" along with most other metal products. Now they may be obtained only for important war projects where they are needed to eliminate the danger of high water flooding valuable property.

In war as in peace these gates are ideal for drainage, flood control, sewer outfalls and wherever else backwater is a hazard. They are easily installed on any type of drainage construction by unskilled labor.

There is a size and type of gate to meet every requirement. These include automatic drainage gates that open and close without power or supervision; light- and heavy-duty slide gates; and automatic radial gates to keep water levels constant.

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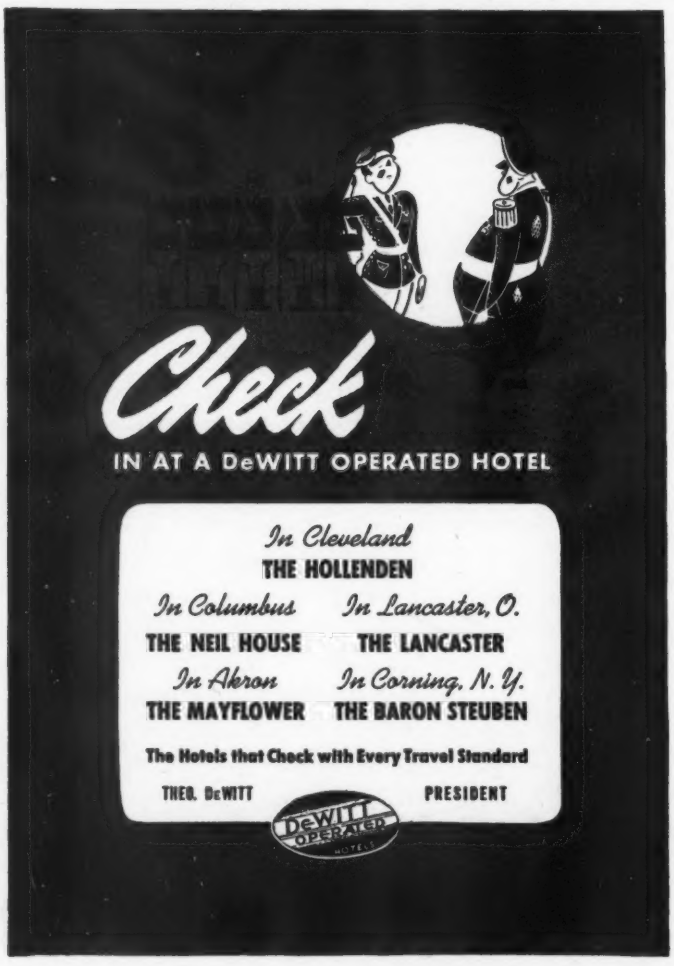

pumping is done at night, filling the tank to provide a large part of the consumption during the day, when the industrial demand is high. (The water consumption averages 920,000 gpd.) This reduces the maximum 15-min. demand by approximately 125 kw, giving a saving of $185 a month for the three busy months and a less amount for the rest of the year.

Road and Street Stabilization

THE surfacing of intermediate and low-type roads and streets at costs within budgetary limits is one of the biggest problems in highway engineering. Lack of durability of such surfacings has been found to be due largely to bad subgrade behavior, and the development of processes by which subgrades can be stabilized is very important. Stabilized surfaces of the newer types also prove satisfactory on many roads, especially for stage construction.

Soils can be provided that serve well as wearing surfaces so long as they remain damp, but lose stability when either wet or dry. For resisting penetration of water, original compaction at optimum moisture content is effective; the aggregate particles being suitably graded to provide mechanical interlock. For retaining adhesive films on the soil particles, calcium chloride is used to obstruct evaporation and absorb moisture from the air; sodium chloride restrains evaporation and causes crystalline deposition on the particle surfaces; while oils, asphalts, tars and portland cement have been used to replace moisture films with insoluble adhesive films.

We can definitely say that stabilization has been put to practical tests and in general has given a good account of itself. The design of mixtures for the graded aggregate type has progressed to the point where three national engineering organizations have standard specifications, which have been adopted by several State, county and municipal organizations. We have established procedures for the proper control of the materials, moisture content, mixing, rolling, finishing and curing. Also the structural and elastic properties of the different components in a road structure can now be measured quantitatively and formulas developed for using these measured quantities as factors for determining the necessary thickness of the base and wearing course for any practical traffic load requirement.

Occasional failures are mainly attributable to the action of some natural laws the mechanics of which we do not definitely understand as yet, such as movement of moisture, rate of freezing and thawing, insulation effect of wearing courses, stabilized bases and granular subbases. Research laboratories are studying these problems. The bituminous interests are investigating moisture movement and waterproofing. The portland cement industry is concentrating on the physico-chemical approach for learning how cement renders soil so resistant to the destructive elements of moisture variations and freezing and thawing. The chemical producers are studying frost control in stabilized bases and subgrades with chemical admixtures, and have learned that 2% or 3% of either calcium chloride or sodium chloride will practically eliminate frost heaving in certain soils at temperatures as low as 15° F.

The general trend in soil-graded aggregate stabilization is toward lower plasticity, less fines, greater thickness of mats, higher density through moisture and compaction control during construction, and more thorough seasoning.

The general trends in bituminous stabilization have been toward development of laboratory tests that reveal more closely the service behavior in the field; leaner mixtures with greater depths; drying the mixture to optimum moisture content prior to spreading and rolling; rolling of thinner layers during construction (a compacted layer of not over 2 inches is recommended for some types of stabilization when pneumatic-tired rollers are used); the obtaining of a firm, hard surface, when a sheepsfoot roller is used on thicker layers, by blading off the upper inch or so of improperly cured material and later combining it with the wetter material in the next windrow before spreading; a greater appreciation of the necessity of proper "curing" of the base before placing a wearing surface and; if at all practical, the modification of heavy soils with granular materials before adding the bitumen.

The service behavior of a stabilized road or street depends a great deal on the construction operations. Two of the most important requisites, in addition to control of materials and efficient mixing, are adequate compaction and proper "seasoning" or "curing." In graded aggregate stabilization it has been shown that, although the rolling operations at ideal moisture content produced 85 per cent of the ultimate density and the remaining 15 per cent of the density was due to the shrinkage compaction or the "seasoning" of the mixture, the corresponding stabilities showed at the end of roller compaction only 10 per cent of the structural stability and the remaining 90 per cent of the stability was obtained during the shrinkage compaction or "seasoning" period.

The above is abstracted from a paper before the Highway Research Board by R. W. Crum, director, and Fred Burggraf, assistant director, of that Board.

Articles From Public Works Magazine Republished Abroad

It is gratifying to see that some of our "Good Neighbors" and good friends across the seas have found articles in PUBLIC WORKS interesting enough to reprint for their own readers.

Among the articles that have been republished abroad recently are:

"Novel Method of Surfacing Roads with Tar" by J. Carroll Boynton in PUBLIC WORKS for August, 1941; reprinted by South African Municipal Magazine.

"The Operation of Sewage Treatment Plants" from PUBLIC WORKS for September, 1938; reprinted in Boletim de Reparticao de Aguas e Esgotos, Sao Paulo, Brazil, which translated it into Portuguese.

"Bridge Records in Mercer County," from PUBLIC WORKS for December, 1941, will appear in an early issue of The Contract Journal, London, England.

"Rapid Airport Construction by WPA" from PUBLIC WORKS for September, 1941; reprinted by Highways and Bridges, London, England.

We have been informed that Boletim de Reparticao de Aguas e Esgotos is translating our book-length text, "The Operation of Water Treatment Plants" into Portuguese for publication in an early issue.

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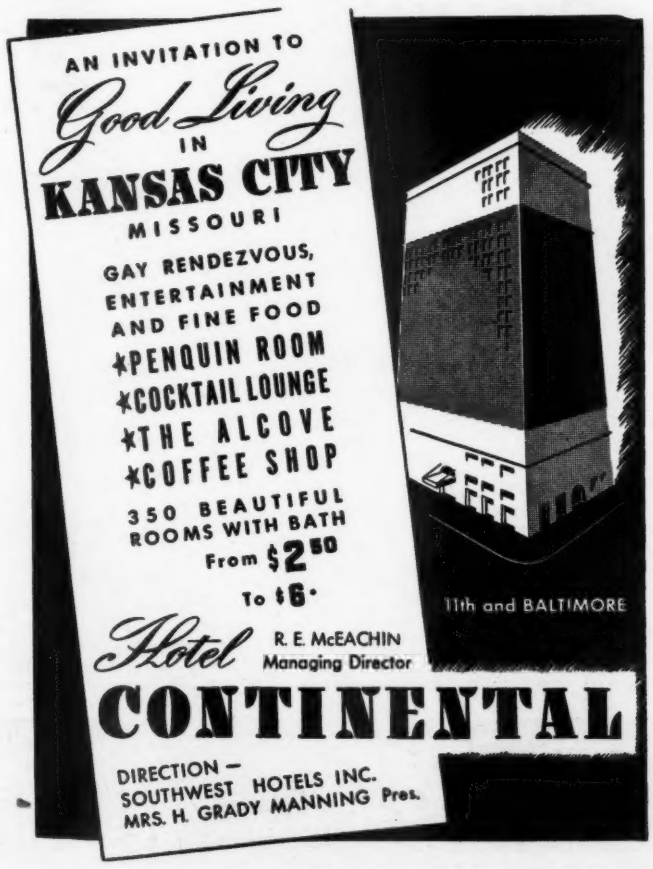

A Study of Laundry Waste Treatment

(Continued from page 15)

cially if ferrisul followed the acid. The following table shows this tendency:

Grains per gallon			*Parts per million*	
Acid	*Ferrisul*		*Residual iron*	*Fats*
—	—	(raw waste)	1.7	254
0	30		0.25	35
6	21		0.45	27
12	11		0.35	30
15.5	5		0.90	40
18.5	3		1.0	—
21.5	2		1.5	—
—	—	(raw waste)	1.7	254
0	26		0.20	15
12	10		0.20	22
15.5	8		0.20	20

The most concentrated sludge found in any of the coagulation work was that obtained from acid and ferrisul. Two samples, one typical of the strongest wastes encountered and the other typical of the weaker wastes, were coagulated with alum alone, ferrisul alone, and ferrisul and acid. The following volumes of sludge compared to the original waste volume were obtained:

	Per Cent of Volume of Original Waste Found as Sludge	
	Weak Waste	*Strong Waste*
Acid-Ferrisul	1.0	5.0
Ferrisul	1.6	9.0
Alum	2.4	12.0

All of these sludges filtered readily and dried within a few days to a hard, dry, water-repelling cake. No evidence of putrefaction was found after several weeks, although the iron-acid cake retained a greasy feeling.

Many other substances, including several the use of which is recorded in the literature, were tried as coagulants but none was comparable to alum or ferric iron. Calcium salts sometimes gave good results, especially if the waste had been acidified to a pH of 2.0 to 3.0. Copper salts gave results as good as iron or alum, but the cost is prohibitive. Other materials tried were calcium chloride (either alone or following sulphuric acid or alum), bleaching powder lime, sulphuric acid alone, magnesium sulphate, common salt, and ferrous sulphate. This last had to be oxidized to the ferric state before it yielded any results.

In an effort to analyze the coagulation of laundry wastes, experiments were carried out on pure soap solutions, in the presence or absence of soda ash. For the coagulation of soap alone, the quantity of alum is directly proportional to the quantity of soap. One grain of alum will coagulate 40 parts per million of soap, dry weight. This is slightly more than that theoretically required for tri-stearate of aluminum, and slightly less than the requirement for bi-stearate. As soda was added to the soap solutions, the amount of alum required increased almost proportionately but never by quite as much as the theoretical alum requirement of the soda. When high amounts of soda were added, complete coagulation of the soap could be obtained with a high residual alkalinity.

Studies were also made on the ether extraction of the waste, both alone and with varying amounts of acid. The amount of grease extracted increased proportionately to the amount of acid added. Following the extraction, the original alkalinity of the waste

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The illustration shows a small "tailor-made" "Blitz Buggy," a mobile chlorination unit to protect your water system against war time disaster and pollution. It includes pumping, purification, fire-fighting, and decontamination units. A still larger "Blitz Buggy" contains extra units which can be quickly dismounted and left on location while "Blitz Buggy" goes on to the next danger point.

Thanks to the exceptionally high pump pressure, big flow capacity (400 gals. per minute) and high chlorine delivery (200 lbs. per day) "Blitz Buggy" can serve a good sized village as a complete auxiliary water supply system; standby for a bombed out plant. When needed, it has the pressure and capacity necessary for fire fighting! It throws an ample stream for decontamination flushing after gas attack.

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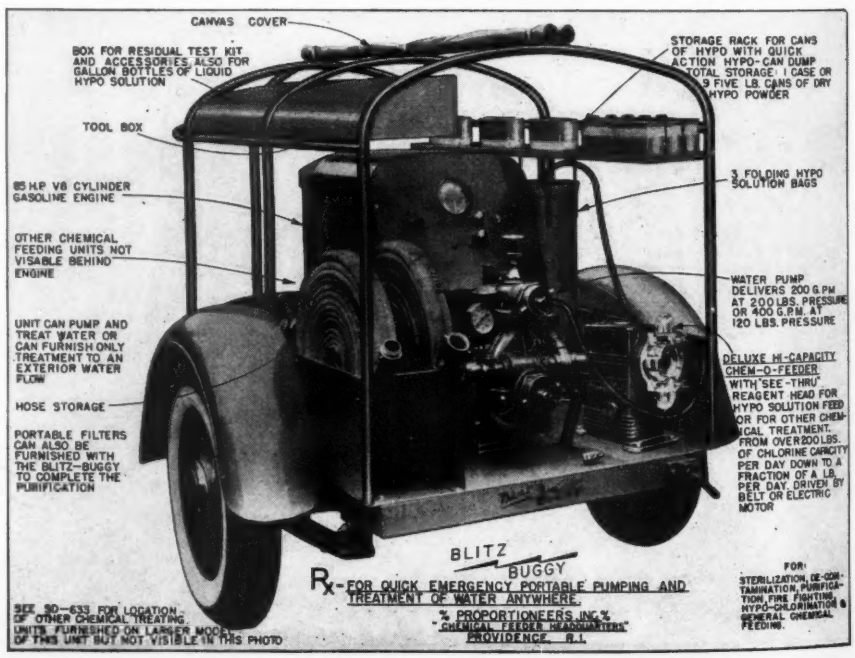
1. "Blitz Buggy" can be completely built to order.
2. You can buy one of %Proportioneers'% many Chlor-O-Feeders and build your own mobile emergency trailer around it.

And, of course, every piece of equipment used will be of service when "Blitz" days are over.

Write at once for New Emergency Sterilization Bulletin EMM.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UNIT CAN PUMP AND TREAT WATER OR CAN FURNISH ONLY TREATMENT TO AN EXTERIOR WATER FLOW
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PORTABLE FILTERS CAN ALSO BE FURNISHED WITH THE BLITZ-BUGGY TO COMPLETE THE PURIFICATION
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was restored, and alum was used for coagulation. The amount of coagulant required was proportional to the amount of grease remaining in the waste, showing that a large part of alum used in coagulation of the original waste had combined with the soap. It had been expected that there would be a decrease in the optimum pH more or less proportionate to the percentage of the grease extracted, but this did not follow.

Preliminary studies on recovery of soap and coagulants from the sludge showed that 75 to 90% of each can be recovered. This would not be economically practicable at anywhere near the present price levels for soap and coagulants, but if these materials should become extremely scarce such recovery might become important.

Extra Strength Clay Sewer Pipe

New specifications, dated April 30, have been issued by the Federal Specifications Executive Committee for vitrified clay sewer pipe, the most important new feature being the provision for a new classification designated as "Extra Strength"; while that previously known as "Double Strength" will be designated as "Standard Pipe." While the latter is manufactured to have a minimum strength of 1,000 lb. per lin. ft. of pipe per foot of diameter when tested by the 3-edge method, the new Extra Strength (up to and including 24" diameter) is specified to have a minimum test strength of 2,200 lb., with correspondingly greater strength in sizes of 10" and under. Such pipe will be branded with the letters "ES."

The additional strength is obtained by improved manufacturing processes and by increasing the wall thickness at least 25%. To permit interconnection with Standard pipe, the outside diameter is made the same in both classes of pipe and the change is made in the inside diameter. This reduces the carrying capacity of the extra strength pipe by less than 10%.

Copies of the new specifications (designated as SS-P-361a) can be purchased from the Superintendent of Documents, U. S. Gov't. Printing Office, Washington, D. C., at 5 cts. each.

Dry Ice for Chlorinating Wells

In a recent letter to PUBLIC WORKS, Willem Rudolfs, Chief, Dept. of Water & Sewage Research, New Jersey Agricultural Experiment Station, gives the following suggestion, which forms a valuable supplement to Mr. Jensen's article on page 21 of our April issue:

"In connection with Mr. Jensen's paper in the April issue of PUBLIC WORKS on the disinfection methods of deep wells, we have used and recommended for a number of years, and obtained considerable success in the distribution of a chloride of lime slurry or high chlorine content solution in wells by the addition of a quantity of "dry ice." The chlorine solution is added first. Evolution of the carbon-dioxide from the "dry ice" creates a considerable mixing of chlorine with water and forces the mixture into cracks and crevices. This method is of particular interest when those mentioned by Mr. Jensen can not be used for various reasons. The quantity of dry ice used has varied from 3 to 25 lbs. Experience indicates that usually from 5 to 10 lbs. is needed to be successful."

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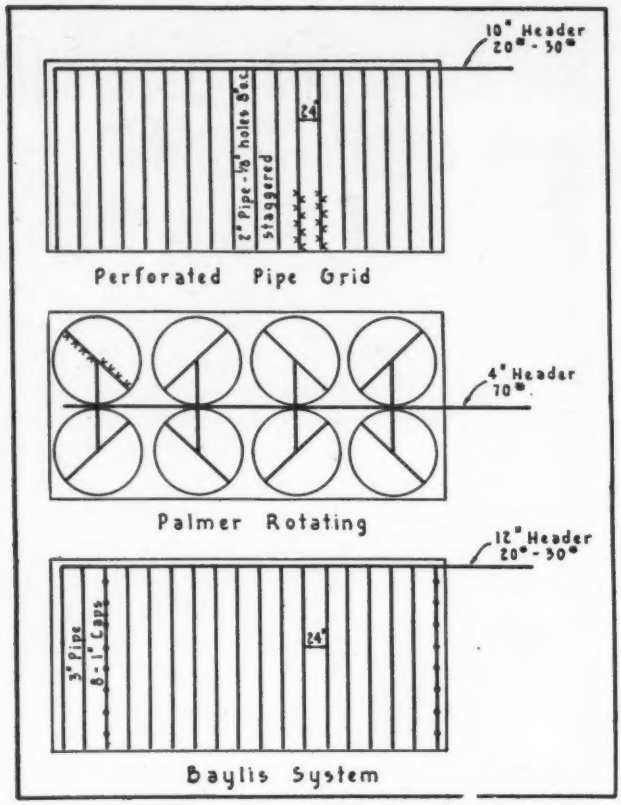
The Operation of Water Treatment Plants

Just published, in the June 1942 issue of PUBLIC WORKS, "The Operation of Water Treatment Plants" is the most up-to-date text on the subject. Contains over 25,000 words. A great help to operators and all interested in water works. Mail $1 for a copy today. If you don't think it the best you have read on the subject you may return the issue and receive your money back in full. Book Dept., PUBLIC WORKS, 310 E. 45th St., New York, N. Y.



Courtesy Water Works Engineering

Three types of surface wash for filters.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Force Account Work Saves $800,000

Oklahoma City is improving its water works at a cost of about $7,000,000, of which about $2,000,000 will be for earth work and riprap for a dam, canal and siphon, which is being done by force account. Sheepsfoot rollers, power shovels, dump wagons, tractors, scrapers, elevating graders and the other equipment valued at $500,000 is rented at 11½ cts. per cu. yd. of earth placed, and maintenance of it is contracted for at 3½ cts. per cu. yd. By April 1st 1,604,366 cu. yd. had been placed at a cost of 15 cts. for equipment as above, 1.9 for fuel and oil, 1.33 for salaries, skilled labor 8.02, unskilled labor 1.24, all other 2.02. The total, 29.51 cts., is 20.49 cts. less than the price of the lowest bid received for this work. About 2,600,000 cu. yd. of fill remains to be done.[E15*]

Rejuvenating Wells With Chlorine

The University of Illinois in 1935 had two gravel-packed wells constructed, one 160 ft. deep with 55 ft. of 26" screen, the other with only 25 ft. of screen. The former had a specific capacity of 100 gpm, which had decreased to 24.5 by 1940. As the ground formation contained calcium and magnesium bicarbonate it seemed probable that these had formed deposits on the screens. The well was surged, over 400 gal. of 20° Baume muriatic acid was emptied into the well in three installments, and the well surged again; this increased the specific capacity to only 38 gpm. The other well then was treated with chlorine, 124 lb. being applied, and the specific capacity rose to 60 gpm, increasing to 66 after the same acid treatment as the first well.[L5*]

Prestressed Concrete Tank

The first prestressed gunite water tank in Canada is being built by the town of Ste. Anne de Bellevue, Quebec, with a capacity of 200,000 gal., 38 ft. inside diameter, supported on a cylinder 88 ft. 6 in. high and 35 ft. 6 in. inside diameter. The tank wall will have a minimum thickness of 4 in.[M14]

Mutual Aid Plan In Westchester County, N. Y.

The county contains 573,000 population and 42 public water supply systems. Inventories were obtained from them covering personnel, equipment and a list of pipe valves and fittings of the type required for repairs. Perpetual inventories seem to be impracticable but municipalities notify the Mutual Aid center of any considerable changes. The center checks up and notifies any water department of its deficiencies in reserve stock. In small departments, auxiliary personnel should be trained in shutting valves, given keys and assigned to definite sections, and arrangements made with local plumbers for repairing mains. Where there is a large regularly employed personnel, this should be trained for such work.

The County has a control room with two wires that the telephone company will leave open during an air raid, and two private wires to the District Warning Center. In the control room are plans of all the water systems, inventories of supplies, telephone numbers of all water department heads, contractors, highway officials, etc. When the Army gives the warning signal, eight members of the staff man the telephones in the District Warning Center and the control room.[G23]

Surface Wash For Filters

In recent designs practically all Great Lakes plants include some form of surface wash. At Milwaukee, Racine and Kenosha, pipe grids are located immediately above the surface of the sand, spaced 20" to 42" centers. The cost of installation normally lies between $160 and $400 per mgd of filter capacity. Surface wash has demonstrated its ability to maintain beds free from mud balls. The maximum amount of wash water required for both under and surface wash does not exceed 22" to 24", even during warm water periods.[F55]

Value of Accounting

Accountant's records furnish a superintendent with: 1. A summary statement of operating revenues and expenses. 2. Detailed analyses of revenues and costs, by groups. 3. Unit-basis operational cost statements, such as cost per consumer or per mg. 4. Unit-basis construction costs, such as per foot. 5. Up-to-date inventories of materials and supplies. 6. Complete inventories of equipment and other fixed assets. 7. Records of water consumed and billed. 8. Unit costs of fuel or power used. 9. An accurate and complete balance sheet, including proper reserves.

On the other hand, the accountant depends upon the superintendent for: 1. Classification of nearly all expenditures, the proper accomplishment of which directly affects the accuracy of reports and statements. 2. Ascertaining that stock rooms are supplied, that the proper stock records

*See Bibliography in the June issue.

are kept, and that issues are made only with proper authorization. 3. Estimation of life of equipment. 4. Proper differentiation between replacements or maintenance and additional or new equipment and buildings, using inventory records in the allocation. 5. Preparation of unit cost statements, data on fuel consumed, power used, pipe laid, gallons pumped and similar information. 6. Meter data.[A90]

Perforated Pipe Filter Underdrains

The U. S. Engineer Office, Washington, D. C., questionnaired the 69 cities of the United States that use perforated pipe underdrains, of the 192 cities that have over 50,000 population. Of these 192 cities, 91 have rapid sand filters, 22 of them using some other type of underdrain. Of 65 replying, 32 would not change from pipe underdrains, 12 would change, 8 "think not," 5 "think yes;" 8 did not express an opinion.

Surface wash was used by 5 using fixed pipes and by 5 intermittently by hand. Only 4 favored air agitation. The vote was about 2 to 1 in favor of high velocity wash.

The authors conclude that plans for filters should include provision for surface wash and also for high-velocity wash. Short underdrain laterals, 5 to 7 ft. long, predominate in plants of all sizes, but recent trend is toward lengths up to 12 or 14 ft. For the larger filters, perforated pipe diameters of 3 to 4 in., spaced 8 to 12 in. are favored; for the smaller ones, 2 in. with 6 in. spacing. Center location of the main wash-water gullet is preferred for large filters, the front position for the smaller ones.

There are many different designs and details of filter underdrain systems in satisfactory use. Availability of materials, character of water, cost comparisons and other factors will indicate which system is most desirable for a given case.[A91]

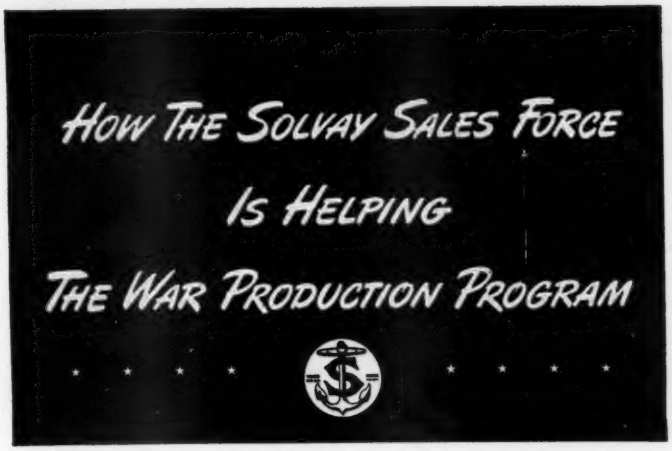
Threshold Odor Tests

In making threshold odor tests, every measurement is a *comparison* of two or more specimens, and two or more values of the same odor are equally valid if the same technic has been used and no other changes have occurred. The threshold odor shown by one dilution of a solution has as much validity as any other, including a 100% portion, providing no changes have occurred in preparation. Observers making T O tests should be tested on the basis of agreement of duplicate samples. Weighted values permit averaging the results of tests made at different reflex levels, and frequently reveal whether the source of disagreement is a particular sample or an individual. Deviations between tests of a single observer are as great and frequent as between observers of equal accuracy. Deviations from average values show typical probability curves of frequency. Dilution prepared in advance develop odors out of proportion to the dilution, so dilutions should be tested immediately.[A92]

Minimizing Use Of Critical Materials

One way of effecting this is to postpone replacement. Most water departments scrap meters when cost of repairing them exceeds about 50% of the cost of a new meter. During the war emergency, continuing to make repairs might postpone purchase of a new meter. Cast iron meter casings might be substituted for bronze in new meters.

In general in the mid-west, a water main loses 40% of its carrying capacity in 35 to 40 years; when in this condition, cleaning a 20" pipe is equivalent to laying a new 14" line; cleaning a 12" main is equivalent to laying a new 8" main. Where there is a long force main, its delivery can be increased 40% by installing a booster station at mid-length. Capacity of a distribution system can be increased by ground storage reservoirs, filled from the system at night, from which water is forced back into the mains by a booster pump during peak flow. In one case, a 250,000-gal. reservoir and 1 mgd pump, requiring 20 tons of critical materials, gave the same relief as would 300 tons of pipe, valves and fittings.



Like many another manufacturer, we shifted to a war time production basis almost overnight. As a part of this program it has been necessary to curtail our sales solicitation in order to use some of our salesmen for other duties.

Other Solvay salesmen have taken over the work of those men who have been transferred. In addition, sales calls of Solvay salesmen have been "pooled" wherever possible in order that more territory can be covered with limited use of automobiles.

Perhaps, for the time being, a "new" Solvay face will be making sales contacts in your district. You can rest assured that this man knows his business . . . that he will try to be of utmost help in solving your problems.

In return for the extra hours these men are now putting in, would you try to make your Solvay salesmen's calls as effective as possible—to your advantage and to his—by promptly giving him the time he needs . . . even thinking ahead of time how you and he can work best together to save just a little more time for some other customer's problem?

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Copper service pipe is practically unavailable. Service life of steel service pipe can be greatly lengthened by bituminous coating and wrapping with fabric.

Cast iron pump impellers can be made equal to bronze in finish and efficiency. Repairs to impellers and other pump parts can be made by a hot-spray process of metalizing; stainless steel is excellent for this purpose.[A85]

Setting Ten Meters a Day

In January 1941 the Hartford (Conn.) Met. Dist. Water Bureau took over the supply of a town with 5,100 customers and only 100 meters, and began metering the other 5,000, placing the meters at the rate of ten a day. Four men with a fully equipped truck averaged 120 per 44-hour week, at a cost for auto, material and labor of $4.13 a meter for 5/8″, and $7 for 3/4″ and 1″; or $21.75 (exclusive of meter) for setting underground.

There were no reliable records of location of service pipe shut-offs, and a special gang located them, using a Ford car, pick, shovel, dipping needle, tape, pipe locator, and bicycle wheel odometer. The locator traced one service pipe through a garden, under a neighbor's garage and nearly 300 ft. further across a tobacco field to another street.[F57]

San Francisco's Emergency Cistern Supply

In addition to its regular public water supply and a separate high-pressure fire system, San Francisco has 7,950,000 gal. of water stored in its business section in 106 underground cisterns, with not more than 1,000 ft. between adjacent cisterns. These are of reinforced concrete, 30 ft. diameter, walls 10 ft. high, bottom dished 3 ft. and roof domed 5 ft. Two manholes in the dome permit dropping suction hose into the cistern. To minimize damage by earthquake or bombs, no pipe is connected to the cisterns but they are filled by fire hose through the manholes. That the whole cistern can move as a unit was demonstrated when one just completed was floated 6 ft. off its foundation by a heavy rain that poured water into the excavation before backfilling. The average cost was about $6,000 a cistern.[F58]

Water for Fires If Mains Are Broken

Main sizes in the U. S. give us better fire service than do those in England, even if broken by air raids. It is calculated that breaks in mains in England average 1 per 100 miles of mains per day during raids. To give a stream through 50 ft. of garden hose to reach 20 ft. on the third floor of a house to extinguish an air raid fire requires about 23 lb. pressure at the curb. In general, where the mains are 6″ or 8″ and pressures fair, this pressure would continue to exist outside of a radius of 500 ft. from a broken main; which radius might reach 1,000 for the largest size mains usually found. Moreover, the breaks can generally be shut off quickly—in the majority of cities by closing 2 valves, while in few cases must more than 4 valves be closed. In England the distribution of valves is not so favorable. In general, even if a city here were bombed as fiercely as English ones have been, the damage from fire should not be nearly so great.[G24]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

A *Journal, American Water Works Assn.*
June

85. Repairing for Defense. By Louis R. Howson. Pp. 793-802.
86. Organization and Training of Water Main Emergency Repair Crews. Bulletin, State Office of Civilian Protection. Pp. 803-822.
87. Wartime Control of Public Utilities. By A. E. K. Bunnell. Pp. 823-828.
88. Wartime Procurement Problems of Canadian Utilities. By M. J. McHenry. Pp. 829-835.
89. Relation of County Health Department to Local Water Supplies. By Arthur H. Herberger. Pp. 836-848.

90. Relation Between the Water Plant Superintendent and the Accountant. By Otto K. Jensen. Pp. 849-856.
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93. Water Quality Problems in Small Systems. By Lawrence H. Cook. Pp. 911-914.
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6. Water Conservation in New Hampshire. By Richard S. Holmgren. Pp. 1-7.
7. Flow Tests on 30" Steel Pipe, Lined With Bitumastic Enamel in 1932. By J. D. Carpenter and George M. Roads, Jr. Pp. 8-13.
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13. Lining a Concrete Reservoir. By H. J. Cook. Pp. 70-75.
14. Experimental Treatment of Rancocas Creek Water for Fort Dix, N. J. By Robert D. Mitchell. Pp. 76-83.
15. Recent Developments in the Use of Hexametaphosphate in Water Treatment. By Owen Rice. Pp. 84-101.
16. Edisto River-Goose Creek Tunnel Aqueduct, Charleston, S. C. By J. E. Gibson. Pp. 102-122.

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16. Air-Raid Organization for Water Supply Protection. Pp. 92-95.
17. Chicago's South District Filtration Project. Pp. 97-125.

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51. Operating Practices at Nashville. By Nathan N. Wolpert. Pp. 568-571, 592.
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62. Water Supply Protection Plans in Three States. Pp. 691, 708.
63. Guards Increased at Los Angeles. By W. W. Hurlbut. Pp. 692, 710.

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6. Toledo's New Lake Erie Water Supply. By George N. Schoonmaker. Pp. 316-319.

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15. *p.* Care and Maintenance of Elevated Steel Tanks. By Edward E. Alt. Pp. 18-19, 38.
16. Carbon "Blackout" for Preventing Algae Growths in Reservoirs. By H. O. Hartung and V. C. Lischer. Pp. 20, 37.

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22. *c.* Council Bluffs, Iowa, Constructs Two Concrete Reservoirs. Pp. 11-12.
23. *n.* Cathodic Protection of Pipes. P. 14.
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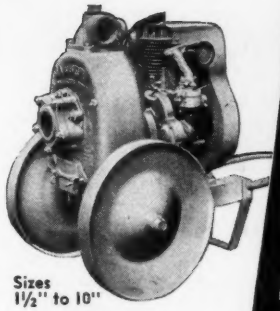

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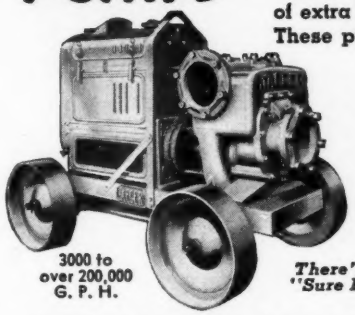

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Sewage treatment plant at Bagley, Minnesota.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Equipment For Trenching

Los Angeles, Calif., used for excavating a 29 ft. trench a ½ cu. yd. shovel with drag shovel and drag line attachments. The drag shovel capacity was increased to ¾ yd. by welding a ⅜ in. steel plate to the back of the dipper and its braces to prevent excess dirt falling out, and substituting preformed 6 x 19 filler wire for the non-preformed for control cables.[G13*]

Designing Sewage Plants

A plant operator makes some suggestions for designing engineers, derived from experience. Among them are the following. Place office and laboratory in a central location. Provide for flexible operation. Use open channels between units instead of pipes. Give machinery protection from freezing and snow. Eliminate outside valves where possible. Keep all motors off the floor. Connect pumps directly to sludge lines. Make pipes large enough and as short as possible. Provide for recirculation of sludge in primary digestors. Don't economize on office and laboratory space. Use stairways rather than ladders.[J8*]

Treating Dye Wastes by Compositing

The plant of the American Cyanamid Co. at Bound Brook, N. J., treats wastes from 725 different products, chiefly dyes, by scientific compositing of them and adding alkaline wastes from another company. The process consists of preliminary treatment of individual wastes at the source, collecting and compositing them, neutralizing acidity, settling and clarifying, and aeration.

Treatments at the source are intended to put the effluents in such condition that the treatment plant can handle them without disturbance. Iron sludges are settled in basins; oils are skimmed off; sulfur is precipitated and recovered. Highly colored wastes are discharged slowly at a uniform rate. The effluents from all these individual treatments, combined with cooling waters, wash waters, process liquors and the sanitary sewage of 4,500 employees are pumped continuously to a 12-million-gallon compositing basin. In this basin acids meet alkalies, reducers mix with oxidizers, colors are equalized, and the effluent has a pH of 2.2 to 2.5 and is free from all bacteria; and the color is tea-like. During the year of operation 500,000 cu. ft. of oily sludge accumulated, which will be pumped to another basin and dried out.

The basin effluent flows through a neutralizer, where the pH is raised to 4.0 by adding waste carbonate of lime slurry from a nearby Johns-Manville plant; the quantity applied being controlled automatically by a pneumatically operated valve actuated by a glass-calomel electrode pH control machine. The effluent then flows to a settling lagoon 23 acres in area, where it becomes more homogeneous and thoroughly clarified. Then it flows through a mile of canal, being aerated by a number of hydraulic stairs, and discharges into the river, the D.O. of which it reduces little if at all.[C48*]

*See Bibliography in the June issue.

Flocculation and Chemical Treatment

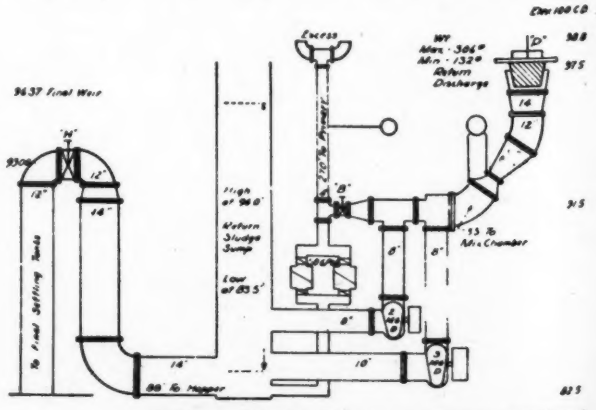
The treatment plant at Circleville, O., is operated during winter and spring by flocculation and sedimentation only, but when the canneries are in operation chemicals are used with the flocculation. Studies made during these two periods lead to the conclusion that, if plain sedimentation is adequate during most of the year, chemical precipitation is economically advantageous, only a small portion of the plant remaining unused. Chemical treatment makes it possible to balance adjustments between attained and required efficiencies. The flexibility of the process makes it adaptable to seasonal use. A major portion of solids removal by chemical treatment is due to purely mechanical effects.[X16]

Semi-Automatic Control of Secondary Solids

Lima, O., since early in 1941 has made the settling rate of its activated sludge control the amount of return sludge, this being effected by use of a back-pressure plug in the discharge of return sludge to the mixed liquor channel and generally by the settling rate of aerated sludge in the final settling tanks, the discharge of which sludge is regulated so as to keep the cone-shaped hopper full of sludge. Set for 1,500 ppm in August, the deviations ranged from plus 21% to minus 24%, and plus 4.6% for the month. This system nearly eliminates operation of the excess sludge pump, saving $10.58 in August, and benefits primary settling by adding excess sludge continuously in small amounts.[X14]

Cleaning Diffuser Plates

Tests and experiences at the Cleveland, O., Easterly plant demonstrate that aluminum oxide diffuser plates can be removed from the Burger-type holders and cleaned economically on a full scale plant basis; the cost, including labor for removing and resettling, being just under 25 cts. a plate. There is no appreciable loss due to breakage of



Courtesy Ohio Conference on Sewage Treatment

Arrangement of device for semi-automatic control of secondary beds.

* This illustration shows the "Impact Test" to determine the toughness and ductility of the pipe. While under hydrostatic pressure the pipe is subjected to heavy blows from a 50-pound hammer dropped from successively increased heights. Although not a required acceptance test, it is one of the additional tests regularly made by this Company to further check and maintain the quality of its pipe so that it will adequately meet severe service requirements. *United States Pipe and Foundry Co., General Offices: Burlington, New Jersey.* Sales Offices in Principal Cities.

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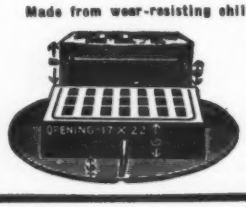
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plates or torn rubber gaskets. It is economical to clean diffusers when the blower discharge pressure increase equals 0.5 lb. per sq. in. and the plate permeability has dropped to about 12.[X15]

Sewage Treatment In Ohio

In 1940, 175 Ohio municipalities had 182 sewage treatment plants serving 3,230,400 people. Of these 58 cities and 117 villages, 27 use activated sludge treatment, 28 use sand filters, 50 use trickling filters, 7 use contact beds, 54 use plain sedimentation and 9 use chemical precipitation only (it is used also in connection with 3 activated sludge plants, 1 sand filter plant and 4 trickling filter plants). Of the total population of the state, 21.5% is served with complete sewage treatment, 8.9% with partial and 69.6% has no treatment, of which 14.5% live in municipalities.[X9]

Effluent of Cleveland's Easterly Plant

The Easterly treatment plant of Cleveland, O., went into operation in the fall of 1938, partly to improve conditions at seven bathing beaches on Lake Erie near the plant's outlet. In the three years of operation the pollution of water at these beaches (as measured by bacterial content and B. Coli) has decreased 91%, although some pollution still reaches the lake from several small streams. The plant effluent is much cleaner than the shore water of the lake and has a pronounced sterilizing effect on it.[X12]

Excluding Light from Filters

Covering trickling filters encourages the filter fauna to scavenge the top layer of the bed by shutting out the cold; also possibly by shutting out light. Thompson at Leeds, on covering one of his experimental filters, found that worms quickly got to work on the surface slime, but immediately disappeared if the cover was lifted for only a few minutes. Also at Wolverhampton, where the filters were enclosed with wood, pounding, when it occurred, always was found opposite the glass inspection window.[D19]

Protecting Plants From Air Raids

An English engineer recommends as follows: Do not use sand bags outdoors; they rot in 3 or 4 months, or in 2 or 3 years if treated with preservative. (England has a damp climate.) They can be used indoors, but the bags should be treated with a mixture of copper sulphate and washing soda, or with tar or creosote; and the walls have a broad base. For external protection, place, 3 ft. from windows and doors, walls of 13½″ of brick in cement, or 30″ of sand or earth, 10″ of reinforced concrete, or 1½″ of mild steel. The roof can be made proof against incendiary bombs by ¼″ steel plate, or 4″ to 6″ of concrete, or 18″ to 24″ of sand or earth.[H35]

Plant to Operate 9 Hours a Day

A plant to treat the sewage from the new War Dept. Office Bldg. and military reservation at Arlington, Va., recently completed, was designed for operating only 9 hrs. a day, treating 30 gal. per capita from 40,000 population. The essential features are: two pre-aeration tanks, 30 min. detention. Two sedimentation tanks, 3 hr. detention period. Two sprinkling filters, 10 to 25 mgd dosing rate. Two final settling tanks, 2.25 hr. detention period. Two sludge digesters, capacity 3 cu. ft. per capita on a 9-hr. basis, or 1.7 cu. ft. based on actual population. Four drying beds, total area 12,600 sq. ft., glass covered.[E9]

Chlorination equipment is provided for emergency use. The sewage first passes through comminutors, then through a Parshall flume provided with recording and integrating meter. From the primary tanks the effluent is pumped to the trickling filters, which may be operated in series or parallel, with various ratios of recirculation. The filters can be flooded if necessary. Secondary sludge is returned

by centrifugal pumps to the inlet of the primary settling tanks.

Sludge digestion tanks have floating covers and gas collection. There are two sludge pumps, a duplex plunger type (which supplies the maximum of suction lift for heavy sludge) and a scru-peller (which cuts and grinds scum and trash when present). A monorail system with two half-yard dump buckets remove dried sludge from the beds.

The plant being in a park, near the office building (the largest in the world), a cantonment, etc., made necessary avoidance of nuisance, occupation of a minimum space, and landscaping of the site.[H31]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

D *The Surveyor*
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18. *p.* Experimental Work to Improve the Performance of a Bio-Aeration Plant. By John Hirst. Pp. 147-148.

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19. *p.* Sewage Filtration. By John Hurley. Pp. 157-158.

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20. The New Conception of Percolating Filters in Sewage Purification. By Reginald W. Covill. Pp. 165-166.

E *Engineering News-Record*
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8. War Conditions Favor Landfill Refuse Disposal. By Rolf Eliassen. Pp. 72-74.
9. Unique Sewage Plant for War Office Building. P. 85.

G *Water Works & Sewerage*
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15. *p.* Defense Measures for Sewage Works. By Seth G. Hess. Pp. 220-221.
16. Sewerage Betterments of Englewood, N. J. By Henry H. Stephens. Pp. 225-227.

H *Sewage Works Engineering*
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31. Sewage Treatment for the New War Department Office Building. By C. R. Velzy. Pp. 286-288.
32. Detroit Drafts Septic Tanks Code for Remote Areas. By L. Glenn Shields. Pp. 289-291.
33. Shepherd's Hills Get Sewers and Flocculation. By V. M. Roberts. Pp. 292-294.
34. Sewage Treatment Plants in U. S. A. Pp. 295-299.
35. Wartime Problems in Sewage Treatment. Pp. 305-306.
36. Sewage Works Operation Problems. Pp. 307-309.

J *American City*
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9. Indiana Studies Facilities for Suburban Sewerage. By B. A. Poole and Joseph L. Quinn, Jr. Pp. 52-53.

K *Proceedings, American Soc. of Civil Engineers*
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3. Advancement of Sanitary Engineering. Committee report. Pp. 965-995.

L *Civil Engineering*
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8. Sewage and Garbage Disposal Plant at Gary, Ind. By W. P. Cottingham. Pp. 305-308.

P *Public Works*
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18. *c.* Terre Haute Constructs Sewer by Tunneling. By Robert E. Gibbons. Pp. 15-16, 65.
19. Repairing War Damage to Sewers. P. 67.

X *Ohio Conference on Sewage Treatment*
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9. Development of Sewage Treatment in Ohio. By F. H. Waring. Pp. 17-25.
10. Sanitation Problems in Connection with National Defense. By B. F. Hatch. Pp. 26-32.
11. Cannery Waste Treatment. By N. H. Sanborn. Pp. 33-38.
12. Studies of Bathing Beach Waters of Cleveland. By Paul Van Gieson. Pp. 39-43.
13. Mansfield Sewage Treatment Plant, Design and Operation. By J. R. Turner. Pp. 44-47.
14. Semi-Automatic Control of Secondary Solids at Lima Activated Sludge Plant. By E. E. Smith. Pp. 51-53.
15. Diffuser Plate Cleaning vs. Compressed Air Costs. By Willard F. Schade and J. J. Wirts. Pp. 54-68.
16. Flocculation of Sewage With and Without Chemicals. By Ervin F. Leist. Pp. 69-74.
17. BOD Dilution Water—Past, Present and Future. By R. D. Scott. Pp. 75-76.
18. Design Problems to Meet Operating Conditions. By Floyd G. Browne. Pp. 77-80.
19. Operating Data with Special Reference to Small Sewage Treatment Plants. By G. A. Hall. Pp. 81-82.
20. Improved Sewage Plant Operation at Lakewood. By P. A. Williams. Pp. 83-89.
21. Progress Report of Committee on Corrosion. By Willard F. Schade. Pp. 90-98.
22. Lancaster Sewage Treatment Plant. By Dwight Keller. Pp. 102-105.
23. Screens and Grit Chambers. By Donald Heffelfinger. Pp. 106-110.

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Keeping Up With New Equipment

Sewage Federation Plans Third Convention

Meet in Cleveland, October 22-24, 1942

The Federation of Sewage Works Associations, in conjunction with the Ohio Conference on Sewage Treatment, will stage its Third Annual Convention at the Hotel Statler, Cleveland, on October 22-24th, 1942. It is hoped that this national sewage meeting of the recently reorganized Federation will bring together the leading sanitary engineers, plant operators, educators, manufacturers' representatives and public officials from all sections of the country.

The country's leading authorities will discuss sewage works, student training, state health control, army camp sanitation and industrial waste problems, which have developed as a result of war conditions. Progress of sewage works construction during war times and the question of priorities and conservation of materials will be featured in the discussions. Plant operators will present their experiences in a symposium on plant maintenance in war times which will cover mechanical units, electrical equipment, sewers, structures, personnel, and sabotage protection.

In this period of stress, sanitation plays such an important role that it is expected that the attendance will be swelled by those who deem it essential to attend a war conference at this time. The meeting should be a "must" for every active worker in this field.

Preparations for the Convention are already going forward under the guidance of committees chosen from all sections of the country. The personnel of the Convention committees follows:

Convention Management Committee: Messrs. William L. Havens, Chairman; John J. Wirts, Vice Chairman; F. P. Fischer (Local Finance); Clinton Inglee (Entertainment); W. J. Orchard (Financial Advisory Committee); A. H. Niles; Arthur S. Bedell, Ex-officio Member; Arthur T. Clark, Ex-officio (Exhibits); Charles A. Emerson, Ex-officio Member; W. H. Wisely.

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Inspection Trip Committee: Messrs. J. W. Ellms, Chairman; G. E. Flower; W. E. Gerdel; John J. Wirts.

Entertainment Committee: Mr. J. M. Craun (Assisting Mr. Inglee).

New Floodlights for Routine and Emergency Night Jobs

National Carbide Corporation
60 E. 42nd St., New York, N. Y.

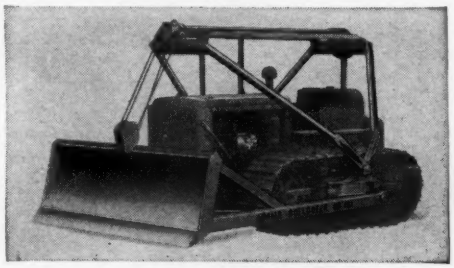
National Carbide Corporation announces that its new line of portable floodlights is a thoroughly dependable source of adequate lighting for construction and repair work, for routine railroad checking jobs, or for any emergency use.

National Carbide Floodlight.

General contractors, at a low cost, by the use of this new line of portable floodlights can maintain night shifts on construction jobs without the usual delay and expense of installing permanent lighting installations.

The new NC-200 model (illustrated), which is the largest unit now being made, has two 8,000 candlepower floodlights constructed on swing joints, thereby allowing independent directional control with 16,000 candlepower concentration of light. This portable floodlight may be used continuously or intermittently, and is always ready for instant use until the carbide charge is exhausted.

Additional information, literature, and prices may be obtained by writing to the manufacturer.



J. D. Adams Bulldozer.

New Bulldozer

J. D. Adams Co.
Indianapolis, Ind.

The J. D. Adams Company has announced the addition of a bulldozer to its line of road building and earth moving equipment. The new bulldozer, known as the No. 181, has been specifically designed for use on TD-18 wide tread TracTracTors. . . . It is single-cabled controlled and is engineered to provide the even weight distribution necessary for good balance and maneuverability. The moldboard is designed to keep earth rolling smoothly at all speeds and is wide and higher than most moldboards. A pusher attachment for use with scrapers is available.

A convenient side-mounted control permits operator to sit in a natural position facing the blade. Operation is by means of an Adams No. 20 Power Control Unit (single or double drum) or any other standard hoist attached to the power take-off of the tractor. For complete information and specifications write the company.

Pittsburgh-National Introduces "Ironside" Disc Meter

Pittsburgh Equitable Meter Co.
400 N. Lexington Ave., Pittsburgh Pa.

The "Ironside" Disc Water Meter was shown at the exhibit held in connection with the American Water Works Association Conference on Wartime Water Works Problems. Immediate production of this meter is said to have been made possible by months of prep-

"Ironside" Disc Meter.

aration by the manufacturer preceding the limitation order by the War Production Board on bronze case water meters.

Rust-proof cast iron and molded glass have been ingeniously substituted for bronze in the outer shell, register box and register lid, making possible a construction in which over 70% of the bronze normally used in a meter of this size has been eliminated. The manufacturer states that the vital inner working mechanism, which has been time-tested and proven in hundreds of thousands of Pittsburgh Arctic and Tropic Meters, requires only a small quantity of critical material. Special care has been devoted to protecting the cast iron surfaces from rust and corrosion. Three separate coatings are applied to the outer casing both inside and out.

The "Ironside" is fitted with a molded glass register box, a recent development from the Pittsburgh-National Laboratories. This is described as a single piece, strong molded glass unit which fits snugly over the register and is retained by two screws against a fiber gasket. This glass register box is designed to serve as both a register box and lid. The manufacturer states that it tightly seals the register against dust and moisture and has sufficient strength to withstand considerable abuse.

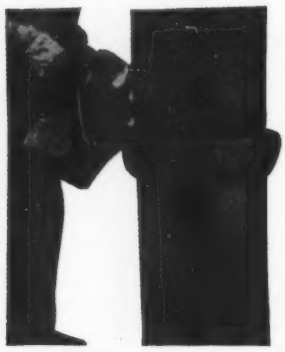
The "Ironside" meter is made in sizes from 5/8" x 3/4" up to and including 2" size. A new bulletin has been prepared, copies of which can be obtained by writing to the manufacturer.

Work Quickly and Economically with

SERVICISED Sewer Pipe Jointing Compounds

TUFFLEX . . . cold troweling plastic arrives at the job mixed, ready for immediate use. The adhesive qualities of this compound eliminate the possibility of foreign matter, ro t growth and infiltration of surface water. **Tufflex** is easily hand'ed and forms a flexible joint. Ideal for special jobs. The cost is low because you profit in time-saving.

Applying Tufflex



Hot-Poured Compound

HOT POURING COMPOUND . . . an inexpensive asphaltic preparation, carefully compounded into a uniform and easy-to-work-with product. A quick-setting compound, producing tough, flexible, long-lasting joint connections. Thousands of pounds of this material have been used by contractors with a high degree of satisfaction. This hot-poured compound is shipped in Fiber Containers that break open very easily. Sizes 10 gals. and 55 gals.

PREMOULDED SEWER PIPE BELT . . . a modern product manufactured to assure watertight, root and acid resistant joints. The ends of each belt are beveled so that a perfect meeting is made for a tight joint with no leakage. This belt is calked into the annular space between bell and spigot of sewer pipes as indicated.

Premoulded Sewer Pipe Belt

Send for descriptive catalog on our "tested methods" of Sewer Pipe Jointing Compounds.

SERVICISED QUALITY PRODUCTS 1930

SERVICISED PRODUCTS CORP.

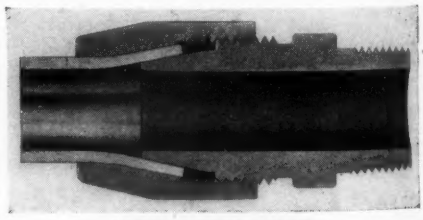
6051 West 65th Street, Chicago, Ill.

New "Dim-Out" Traffic Signal Switch

General Electric Co.
Schenectady, N. Y.

A new control switch developed by the General Electric Lighting Division permits satisfactory "dim-out" operation of traffic signals during a blackout. It allows illumination of the entire lens instead of a reduced area, making for greater traffic safety, but the light is not discernible from the air.

The device can be mounted in the base of the controller cabinet without drilling extra holes in the controller panel or making any wiring changes. It consists of a transformer and a single-pole switch with two positions. With the switch at the "normal" position the signal lamp burns at full brilliancy; at the "blackout" position, voltage is reduced and the lamp filament just glows. A visor must be provided for each signal lens to screen the upward light and decrease the range of the signal beam.



Asarco Type K Tube-Loy

Asarco Type K Tube-Loy

American Smelting & Refining Co.
120 Broadway, New York, N. Y.

The manufacturer says this is a water service pipe, extruded from an alloy of lead, magnesium, calcium and tin. The physical characteristics of lead, the principal component of type K Tube-Loy, have been materially improved by the introduction of carefully controlled percentages of the foregoing elements, and the utility of lead has been considerably extended and increased. And the manufacturer says that type K Tube-Loy is not an emergency product but was being widely utilized prior to current shortages in other water service pipe.

It is recommended where steady working pressures do not exceed 125 lbs. per square inch.

It is installed with Superseal Flared Tube-Loy Fittings developed in 1937 by the Grinnell Company, Providence, R. I. They are made from Air Furnace Malleable Iron, a material used extensively throughout the plumbing field. Fittings so processed will obviously withstand any pressures encountered in water service installations.

The manufacturer states that Asarco Type K Tube-Loy and Grinnell Superseal Flared Tube-Loy Fittings are the result of a 5-year exhaustive study by the research laboratory of the American Smelting & Refining Co., substantiated by independent laboratory and trial installations under severe conditions. Write for a bulletin giving complete information regarding this new water service pipe.

NEW LITERATURE

Surface Consolidation and Maintenance

Calcium Chloride Association
4145 Penobscot Bldg., Detroit, Mich.

"Surface consolidation and maintenance with calcium chloride" offers an ideal means of accomplishing substantial road improvement under restricted war conditions, so a bulletin recently issued under this title is particularly timely. The new 62-page booklet gives a detailed and illustrated presentation of the method and procedure in consolidation operations, and may be obtained without charge by writing to the Association for Bulletin No. 29.

Handbook on Care of Motors

Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

With motors operating 168 hours a week instead of 40 hours as formerly, most books on motor care are now seriously out-of-date. To correct this situation, Allis-Chalmers has just published a new handbook entitled "A Guide to Wartime Care of Electric Motors." Taking a fresh, new slant at the subject of motor care under war conditions, the book is of great value to war plant engineers and maintenance men, and is of particular value for training new men. The book contains no advertising, and is available upon request.

Soil Stabilization Independent of Moisture Content

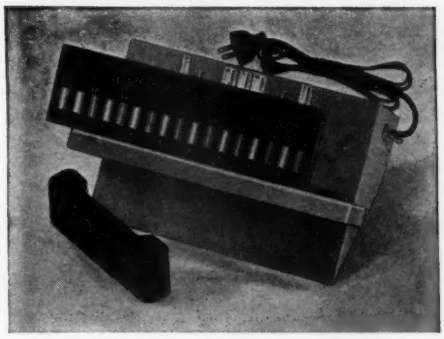
Kotal Company
52 Vanderbilt Ave.
New York, N. Y.

A new bulletin—No. 9 of their series dealing with the various applications of Kotal to bituminous road and runway construction. This new bulletin describes the operating methods for stabilizing soils with asphalt cutback and Kotal which, it is claimed, permits the use of soils running very high in moisture content and eliminates the need for accurate moisture control.

Midget Dalite Lamp

W. A. Taylor & Co.
7300 York Road, Baltimore, Md.

While this lamp was designed for use with single Taylor Slide Comparators when determinations must be made at night or in dark places, it has been found to be ideal for all routine testing even in daylight. The Comparator base sits on the shelf at an angle of 45° so that, in making readings, one can look directly into the slots in the



Taylor Midget Dalite Lamp.

TRAFFIC smash? If your hydrant is a Mathews you don't sweat it back into readiness with pick and shovel and pavement breaker. You simply change it like a tire. You unscrew the broken barrel from its elbow—it contains all operating parts—lift it out through its loose protection case, and replace it with a spare. You repair the barrel at your own convenience in the shop. You save the community money, time, and fire protection. You enjoy a completely interchangeable, overhaulable, frostproof hydrant system. You have the maximum defense in case of bombing. You have Mathews Hydrants, the standard of fire protection for over 70 years.

MATHEWS HYDRANTS
400 CHESTNUT STREET, PHILADELPHIA, PA.
ESTABLISHED IN 1803
Made by R. D. WOOD Company
MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

slide and base. This eliminates handling the outfit, with possible chance of breakage, as only the sample tubes need be handled. Also, in many laboratories and plants, it is almost impossible to obtain a clear daylight background because of walls, trees, etc. The lamp gives uniform daylight conditions at all times. It is fitted with a Dalite glass, special bulb, cord and switch and operates on any 110 V circuit. It can be used with any Taylor pH, Chlorine or Phosphate Comparator.

Emergency Equipment Bulletin

Mine Safety Appliances Co.
Braddock, Thomas & Meade Sts.
Pittsburgh, Pa.

Essential emergency safety equipment for plant protection and public safety departments is completely described in the new 8-page, fully illustrated Defense Bulletin just issued by Mine Safety Appliances Company. This new bulletin, covering the complete range of safety equipment needed during war-time conditions features, on the cover, a suggested grouping of essential items at strategic locations in plant or municipal buildings. Inside pages include descriptions of gas masks, helmets, gas detectors, inhalators, asbestos suits, goggles, respirators, first aid kits, Foille for burns, stretchers, splints and fire blankets.

Copies of this new Defense Bulletin may be secured by writing the company.

Rotary Positive Blowers

Roots-Connersville Blower Corp.
Connersville, Ind.

Rotary positive blowers are covered by Bulletin 22:23-B-11 just issued comprising twenty pages. This bulletin is profusely illustrated, showing numerous installation views, details of construction, etc. It includes a brief account of the inception of the rotary positive blower by the Roots brothers, who patented the principle in 1859. Three interesting curves are presented in connection with a discussion of the operating principle of these blowers.

View of four different types of gears in matched pairs are shown, and the manufacturer stresses the importance of accurate gear cutting. Eight pages are filled with installation views and comment regarding the many varied applications which rotary positive blowers have found in a diversity of industry. Typical accessories are described and discussed in considerable detail. Specifications are given and a table of sizes, including capacity, speed, horse power, etc. A copy of this bulletin may be had by writing to the Corporation.

Electric Sewer Cleaner

Electric Sewer Cleaning Co.
Watertown, Mass.

The machine consists of an electric motor turning 110 ft. of ¾ in. coil spring rod at 120 R.P.M. The rod is

The "Electric" sewer cleaner.

wound of No. 5 oil tempered steel wire which gives it great strength and also the necessary flexibility.

The rod is fed into the sewer by an exclusive patented hand feeding device, which allows the operator to either feed or withdraw the rod while the machine is running. The rod may be fed either fast or slow according to the obstruction encountered. This feature makes the Electric Sewer Cleaner more efficient and foolproof. Each machine is equipped with a patented brass spiral head, one root cutter and a flexible guide tube for guiding the rod into the sewer when necessary. In the event that a longer rod than the 110 ft. original equipment is needed, extra lengths can be purchased. The drum containing the rod is built to accommodate 250 ft.

Worthington-Gamon Meter Company Elects Officers

Harry C. Beaver has been elected president of Worthington-Gamon Meter Company to succeed the late E. T. Fishwick. Mr. Beaver is also president of the Worthington Pump and Machinery Corporation.

R. R. Anderson, treasurer and manager of Worthington-Gamon Meter Company, has been elected vice president and director, as well as retaining his office as treasurer.

Fellows Appointed by WPA

Mr. Perry A. Fellows has been appointed Assistant W.P.A. Commissioner in charge of the Division of Operations. He succeeds R. L. MacDougall, who has been appointed Regional Director of the Federal Works Agency for the Southeastern States.

Conventions and Association Meetings

The Pennsylvania Sewage Works Association's 1942 Conference will be held at the Penn-Harris Hotel, Harrisburg, Pa., August 25th and 26th.

Pennsylvania Water Works Operators Association—Annual meeting scheduled to be held at Penn-Harris Hotel, Harrisburg, August 27th, has been cancelled to cooperate with the war effort.

New England Water Works Assn., annual meeting will be held at Poland Springs, Me., Sept. 15-17.

New England Sewage Works Assn. Fall meeting will be held at Ocean Beach Pavilion, New London, Conn., Sept. 23.

Federation of Sewage Works Associations Annual Convention will be held October 22-24 in Hotel Statler, Cleveland, Ohio.

New Appointments

New City and County Officials recently reported:

City Engineers

E. Tolbert, Greenville, Ala.
H. N. Nelson, Gunthersville, Ala.
Charles O'Keefe, Nogalles, Ariz.
Hilbert Bennett, Rockport, Ind.
J. M. Newberry, Neodesha, Kan.
J. C. Harvey, Parsons, Kan.
Philip Smith, Edina, Minn.
B. F. Walther, Farmington, Mo.
D. D. Hale, Sidney, Mont.
John Stevenson, Auburn, Nebr.
David W. Carmichael, Verona, N. J.
Frank Nollett, Bath, N. Y.
George V. Long, Bucyrus, Ohio.
Chas. Owen, Delaware, Ohio.
Edward O'Brien, Lockland, Ohio.
Charles Wells, Troy, Ohio.
Judson Engrg. Co., Willard, Ohio (P. O. Sandusky).
Artie Marvel, Seminole, Okla.
Thomas J. Halsey, Pittston, Pa.
John A. Gasell, Jackson, Tenn.
S. K. Addington, Kingsport, Tenn.
Chas. Patterson, Kingsville, Tex.
A. McCormick, Corpus Christi, Tex.
Vern D. Sowers, Rawlins, Wyo.

Public Works Superintendents

Frank Swaim, Auburn, Nebr.
Walter E. Nutt, Peekskill, N. Y.
B. L. Pope, Newton, N. C.

City Managers

Ray V. Wilson, St. Augustine, Fla.
Lester Brogdon, Buford, Ga.
H. M. Crane, Cartersville, Ga.
A. F. Newman, Decatur, Ga.
Fred Roark, Gainesville, Ga.
Stewart Clendenin, Gallipolis, Ohio.

Water Works Superintendents

J. L. Grant, Greenville, Ala.
Wm. M. Morse, Derby, Conn.
Robert Kaufman, Greenwich, Conn.
Chas. LeCates, Dover, Del.
F. Middleton, Clearwater, Fla.
G. L. Head, Cartersville, Ga.
J. M. Keaton, Cuthbert, Ga.
P. C. Hutchinson, Dublin, Ga.
F. C. McArthur, Lafayette, Ga.
McDonald Lawrence, Marietta, Ga.
Mart Early, Moscow, Idaho.
Arthur Nedwed, Cicero, Ill.
Guy Morrow, Peoria, Ill.
J. B. Russell, Creston, Iowa.
O. A. Reis, Waterloo, Iowa.
C. A Thompson, El Dorado, Kan.
Jerry Mills, Girard, Kan.
M. E. Rogers, Wichita, Kan.
Thomas E. Kennedy, Fitchburg, Mass.
Carl Van Blarcom, Marblehead, Mass.
Jas. A. Rielley, Ware, Mass.
L. Russell, Anoka, Minn.
E. E. Barton, Carrollton, Mo.
Cameron Fuller, Savannah, Mo.
Troy Godwin, Dunn, N. C.
Samual A. Anderson, Newark, Ohio.
Carl E. Guenther, Salem, Ore.
Louis Affrica, Brackenridge, Pa.
Martin J. McLaughlin, Philadelphia, Pa.
Harvey Wineberg, Springdale, Pa.
Otto Swoboda, Victoria, Tex.
X. D. Minden, Portsmouth, Va.

County Engineers

Elmer H. Brown, Jefferson Co., Madison, Ind.
George Henningsen, Jones Co., Anamosa, Iowa.
B. W. Dutton, Marion Co., Knoxville, Ia.
C. C. Bowman, Jackson Co., Maquoketa, Ia.
Robert Vance, Fremont Co., Eidney, Ia.
A. R. Bartell, Cedar Co., Tipton, Ia.
Emmon Robbins, Thomas Co., Colby, Kan.
Edwin P. Knapp, Smith Co., Smith Center, Kan.
G. G. Auxier, Johnson Co., Manila, Ky.
Arvid R. Hicks, Gratiot Co., Ithaca, Mich.
Ray G. Hafey, Montcalm Co., Stanton, Mich.
B. C. McCleary, Coal Co., Atoka, Minn.
Robert Conard, Clinton Co., Wilmington, Ohio.
Elmer Fields, Garvin Co., Pauls Valley, Okla.
C. P. Fauerso, Wasco Co., The Dalles, Ore.
Fred Fleming, Overton Co., Livingston, Tenn.
Clyde Herberling, Stevens Co., Colville, Wash.
Harrison Hawkins, Adams Co., Ritzville, Wash
C. E. Ellis, Putnam Co., Hurricane, W. Va.
Wm. F. Hunter, Vilas Co., Eagle River, Wis.

Readers' Service Department

These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Air Raid Shelters

3. New 8 page booklet pictures and describes a corrugated pipe shelter with gas tight end walls, emergency escape tunnel and other desirable features. Armco Drainage Products Assn., Middletown, Ohio.

Asphaltic Limestone

6. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Bridges

7. Teco Connectors, a new method of structural engineering, to spread the load on a timber joint more equally over the cross-section of the wood is described in new literature available from Timber Engineering Co., Inc., Dept. BS-2, 1319—18th St., N. W., Washington, D. C.

8. Lt.-weight, non-skid, mineral surfaced asphalt planks for any type bridge. Write for latest catalog. Servicised Products Corp., 6051 West 65th St., Chicago, Ill.

Cement Dispersion

9. "Economics of Cement Dispersion and Pozzolith" tells the complete story of how cement dispersion reduces water required up to 20% and increases workability 150%. Write The Master Builders Co., Cleveland, Ohio, for a copy.

Cement, Early Strength

11. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit, Mich.

Cold Mix Plants

15. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

73. "Principles of Design of Airport Drainage" and other articles on airport drainage reprinted from PUBLIC WORKS Magazine are being distributed free by Bowerston Shale Co., Bowerston, O., Hancock Brick & Tile Co., Findlay, O., and Columbus Clay Mfg. Co., Blacklick, O. Address anyone of the above for a copy.

Graders, Patrol

105. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Road Machinery Co., Aurora, Ill.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Oil

109. Ring-Free Motor Oil that keeps motors clean and free from carbon, and reduces frequency of overhauls is described in literature available from Macmillan Petroleum Corp., 530 West 6th St., Los Angeles, Calif.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 ills. Write to The Barrett Div., 40 Rector St., New York, N. Y.

Pumps

120. Interesting new booklet tells how to lengthen the life of your pumps. Explains how a little care will save a lot of wear. Write today for your copy. Homelite Corp., 2403 Riverdale Ave., Portchester, N. Y.

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

Road Building and Maintenance

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Gallion Iron Works & Mfg. Co., Gallion, Ohio.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio

140. This well-illustrated 16-page catalog describes the tandem, autocrat, cadet, and roll-a-plane rollers, and explains what each is intended to accomplish. Write Austin-Western Road Mach. Co., Aurora, Ill.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Chemical Division will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Chemical Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Div., 40 Rector St., New York, N. Y.

Spreader

187. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Surface Consolidation and Maintenance

188. Detailed and illustrated presentation of the method and procedure in consolidated operations; explains how sub-soils can be conditioned to resist softening and frost action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit, Mich., for Bulletin No. 29.

Timber Structures

189. "Typical Designs of Timber Structures" contains plans for 45 representative structures that have been engineered with Teco Connectors. For free copy write Timber Engineering Co., Inc., Room 6GG, 1319—18th St., N. W., Washington, D. C.

Street and Paving Maintenance

190. "Blacktop Road Maintenance and Construction Equipment"—Asphalt and tar kettles, flue type kettles, spray at-

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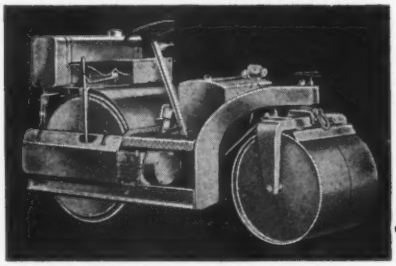
C. H. & E. MANUFACTURING CO.
3841 No. Palmer St., Milwaukee, Wis.



PUMP FOR SALE

AMERICAN WELL WORKS PUMP—Fig. NMO-ABB; RPM—3500; GPM—40; Head—140.

Motor—U. S. Electrical Motor, three phase, 10 H.P.; RPM—3600; 40 Cycle; Volts 220-440; 27 Amp.; Serial No. 93216.

Complete with 170 feet of tubing.

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198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., Ford Bldg., Detroit, Mich., tells how to use calcium chloride for modern ice control.

Sanitary Engineering

Aero-Filter

356. "Results Produced by Aero-Filters" is a new pamphlet covering results at Temple, Texas; Paris, Ill.; Webster City, Iowa; and Mason, Mich. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20 pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Chlorinators, Portable

380. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark, N. J.

381. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from Proportioneers, Inc., 96 Codding St., Providence, R. I.

Cleaning Mains

382. "Let's Look Into the Matter of Water Main Cleaning" is an illustrated booklet outlining the advantages of water main cleaning and explains how it can be done quickly and inexpensively by The National Method. Write National Water Main Cleaning Co., 30 Church St., New York, N. Y.

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385. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

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390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M & H Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

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408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

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Pipe, Transite

414. Two new illustrated booklets. "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

Pipe, 2-inch Cast Iron

417. Generously illustrated booklet describes McWane 2-inch cast iron pipe and its manufacture in streamlined pipe shop. Write McWane Cast Iron Pipe Co., Birmingham, Ala.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

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430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

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434. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

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440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Softening

444. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 4809-15 Tod Ave., East Chicago, Ind. Write for a copy of this instructive folder.

Sprinkling Filters

445. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

Swimming Pools

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

449. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y.

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

451. Powdered Hydrodarco for taste and odor control. For complete data on its use write Darco Corp., 60 East 42nd St., New York, N. Y.

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453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

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Valves (See Gates, Air Release, etc.)

Waste Elimination

469. Full information on the Pitometer Survey—a complete check-up on your water plant to reveal hidden sources of waste—will be sent promptly by The Pitometer Co., 48 Church St., New York, N. Y.

Water Treatment

470. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., Inc., 4809—15 Tod Ave., East Chicago, Ind., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

471. Lime specifications and full impartial data on water treatment with lime may be obtained from National Lime Assn., 927 Fifteenth St., N. W., Washington, D. C.

472. Bulletin describes stabilizing lime-softened water by recarbonation, discussing gas production, washing, compressing, drying, and applying the CO(2). Infilco, Inc., 325 West 25th Place, Chicago, Ill.

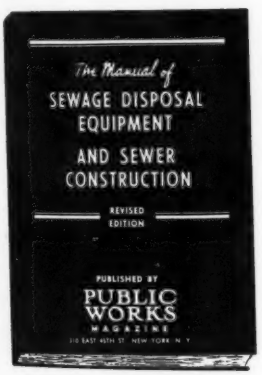
473. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York, N. Y.

Water Works Operating Practices

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St. Cincinnati, Ohio.



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LETTERS *to the Editor*

The Operation of Water Treatment Plants

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We have about 25 students enrolled in the course. I do not know how many would buy the magazine, but I would gladly pay all the transportation both ways, if you send say 20 copies of each issue.

Yours truly,
E. J. M. BERG
Superintendent

Editor's note: We make a special price for copies in quantity.

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Alton, Illinois

We wish to order an additional copy of your June, 1942, issue which contains the most complete condensed form of water treatment plants that we have read for ages.

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Yours very truly,
O. E. GWILLIM
Secretary

OLSEN, DEITRICK, CARR & J. E. GREINER CO.
Cherry Point, N. C.

The writer has read with much interest the article entitled "The Operation of Water Treatment Plants" appearing in your June, 1942, issue of PUBLIC WORKS, and would appreciate having if possible a half dozen or so reprints of this edition.

If it is not possible at this time to have reprints, I would certainly appreciate having a copy of this issue for my personal use.

Thanking you in advance, I remain
Very truly yours,
MILO F. OHR
Chief Sanitary Engineer

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